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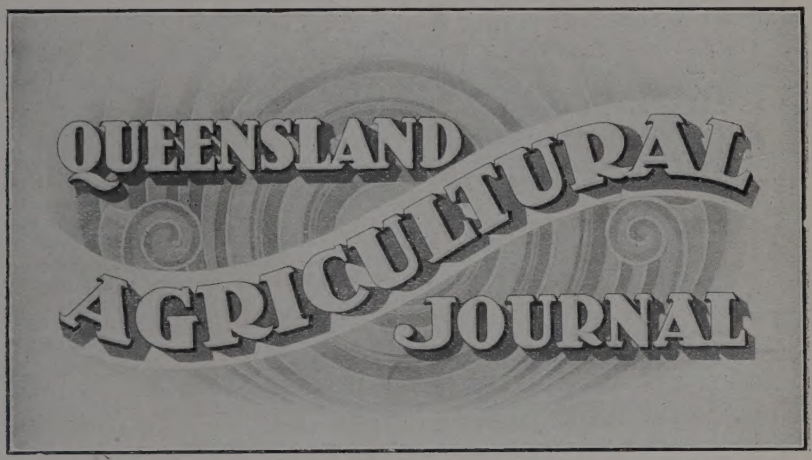

VOL. XXXVI. 1 NOVEMBER, 1931. PART 5.

Event and Comment.

The Agricultural Year in Queensland.

REVIEWING generally the agricultural year in Queensland in his Annual Report to the Minister for Agriculture and Stock (Hon. Harry F. Walker), Mr. E. Graham, Under Secretary and Director of Marketing, said that apart from depression in price levels, a common experience of rural industry the world over, sound progress was made in every department. This was assisted by the generally good season that prevailed in every agricultural area, and other factors were improved practice in every branch of primary production, the recognition of the immense value of agriculture in a period of national reconstruction made necessary by the universal economic conditions, and the imperative call for higher standards in an increasingly competitive age. The special problem of agriculture at present is that of maintaining and increasing the production of exportable products, which will help materially in preserving a national economic balance.

Economic stability was most noticeable in the well-organised industries. Queensland farmers are fortunate in their possession of a system of organisation that is proving its value in the present abnormal conditions affecting production, trade, and commerce. They have sound reason for satisfaction with the system operating in this State, and commendation for the statesmanlike vision of its promoters. No stronger test, up to which it is standing well, could be placed upon it than that imposed by the present crisis in our affairs. An unorganised agricultural industry dealing with highly-organised business in the world to-day is unthinkable. Queensland farmers realised this in time, and the system of organised marketing erected by them is proving one of the best protective measures that they could have devised. Every primary industry is affected by the losses due to the general business slump and the world-wide price decline. In the unorganised, or partially organised sections, commodity disposal remains largely out of balance with the market.

Departmental services during the year, added Mr. Graham, covered a wide and extending field of effort, and to their success is due, in a large measure, the technical progress made in primary production in the State. On the scientific side, farmers who realise the value of research are its strongest supporters. Notable results were achieved in entomological and veterinary scientific work, in the administration of live

stock laws and regulations, and the adoption of control methods for the suppression of animal and vegetable pests and diseases. In dairy cattle breeding and herd improvement, principles were developed which are being applied more widely and which should increase greatly the productivity of our milking cows. The Departmental herd improvement scheme, supported strongly by dairy farmers, is recognised as an important means of translating dairy science into dairy practice.

The grasslands form one of the greatest natural resources of this State, a resource which has been much neglected. Experiments of recent years show that by no other avenue in crop husbandry can greater increase in yield and quality be gained than by correct management of our grass crop.

It is pleasing to record that there is a manifestation of keener interest in pasture improvement, and an indication of a fuller realisation of the wealth of biological forces that are at work constantly in a grazing field. Pastures constitute the fodder for the raising of stock, sheep, cattle and horses, and are the raw material for the formation of milk, cheese, butter, beef, mutton, wool, hides, tallow, and other by-products which comprise the major portion of our trade and commerce with Great Britain and other countries. It is estimated that 60 per cent. of the total exports of the Commonwealth are derived from grass land sources, and in the case of Queensland the percentage is relatively higher, and possibly exceeds 80 per cent. Is it necessary to say more in order to stress the importance of pastures and their intimate relationship to our everyday life? The correlation between improved pastures and increased wealth is obvious.

One of the notable events of the year was the ratification of a reciprocal trade treaty with Canada which was announced recently. There has not been time yet, of course, to observe any effect on the tariff due to this arrangement, but it is difficult to estimate the advantage that must accrue from it to Queensland agriculture. It is true that the Dominion is also a country of primary production, but the fact that Australia and Canada are situated in different hemispheres with opposite seasons provides an opportunity for Queensland trade in tropical fruits, temperate fruits, and other produce for which Canada has an off season, but which, nevertheless, are in constant demand.

John Monash.

ONE of the saddest events of the month, and of the year, was the death of Lieutenant-General Sir John Monash, G.C.M.G., K.C.B., V.D., D.Eng., D.C.L., LL.D., B.A., which occurred in Melbourne on 8th October. He was one of the most distinguished of the Allies' leaders in the European war, probably the first soldier who was a civilian at the outbreak of hostilities in 1914 to attain to the command of an army corps on the Western front, and one of the most gifted of Australia's sons. His death marked the passing not only of a great soldier, but of an Australian whose outstanding capacity in civil life, before and after the war, has left an enduring impress on the industrial and economic life of the Commonwealth.

Great honours and the elevation to high command in a time of national crisis left the man in John Monash quite unspoiled; his peculiar qualities of mind and character won for him an affection in the hearts of every Australian soldier who fought under him in Gallipoli and in France. Though already an expert fighting force under General Birdwood when General Monash took command, the Australian Corps under him acquired an added strength and prestige which fixed its splendid reputation definitely in the annals of British arms.

To him was accorded that rare honour—knighthood on the field of action. That simple and profoundly impressive ceremony performed by His Majesty the King at Bertangles on 12th August, 1918, remains a lasting memory with every surviving Australian soldier who was privileged to witness it. "In the uniform he wore, stained with long service as becomes a man," he knelt to receive the accolade at the hands of his Sovereign in the presence of five hundred men—one hundred from each of his famous Divisions—stalwart Diggers, gaunt and grimed, yet fit and keen, "the toughest veterans in Normandy" relieved for the occasion from the battle line. On all sides parked wheel to wheel were captured guns, first trophies of the great advance that commenced four days earlier, and continued to the final Australian victory at Montbrehain after the breaching of the Hindenburg line, and ended with the Armistice. Could any commander ask for a finer guard or receive a higher honour?

As a volunteer soldier in an unprecedented emergency that called for big men, and as a plain citizen whose work in peace surpasses even his achievements in war, his record was truly remarkable. Efficiency always his aim, he left nothing to chance. He demanded the best in men and got it, and retained in an extraordinary degree the confidence and goodwill of all ranks of the Australian Corps. When the tremendous tasks of war were ended, he returned unobtrusively to civil life in which

he was to win still further distinction in the service of the Commonwealth. He was a Doctor of Engineering, a Doctor of Laws, a Bachelor of Arts, and Vice-Chancellor of the Melbourne University; as well as a D.C.L. of Oxford and a LL.D. of Cambridge, and a past president of the Australian and New Zealand Association for the Advancement of Science.

It was characteristic of the man in all his triumphs to pay just and well-merited tribute to those who served under him, from the Digger to the Divisional Commander, and this is shown right through his brilliant post-war memoir—"Australian Victories in France in 1918." In the words of the Governor-General, Sir Isaac Isaacs, all Australia mourns the loss of "one of her ablest, brave, and noble sons, a loyal servant of King and country, distinguished alike in peace and war, a true comrade of those he led in the defence of liberty, a faithful administrator, a skilful commander, and a public-spirited citizen, whose watchword in all he undertook was the complete performance of his duties as he saw them. He served Australia and the Empire well, and in his passing he has left an example which will be a beacon light of patriotic and unselfish endeavour."

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THE QUEENSLAND SUGAR INDUSTRY.

By H. T. EASTERBY, Director, Bureau of Sugar Experiment Stations.

PART XX.

(e) Health in the Tropics.

THE bogey so often raised as to the deterioration of the white race in the tropics of Queensland and the pernicious effect of the climate on the stamina of the people dwelling therein, appears now to have been pretty well laid. In the early days of settlement for sugar-growing, there were some grounds for thinking that the climate might ultimately prove injurious, for malaria to a limited extent and coastal fevers of divers descriptions were from time to time prevalent, particularly in what were then called "scrubs," but which now rejoice in the perhaps more scientific term of "rain forests."

Ling Roth, writing in 1880, stated that the mean death rate for Australia was 16·32 per 1,000, and at that time the death rate in Queensland was 17·25 per 1,000. The death rate in other tropical countries was given as under:—

Country.	Year.	Death Rate per Thousand.
Mauritius	1876	27·50
British Guiana	1875	36·38
Barbados	1876	21·76
St. Vincent	1872–6	28·00
Antigua	1875–6	32·87
Trinidad	1876	30·50
Montserrat	1874–5	20·44

In the evidence given before the 1889 Royal Commission on the condition of the sugar industry in Queensland which has been previously referred to, some of the witnesses in the far North said there was a great deal of fever when the scrub was being felled and that Europeans suffered more than Chinamen.

Doctor G. T. White, of Innisfail, told the Commissioners that the general health improved as the scrub got cleared. Europeans generally suffered from malarial fever. At one time it was of a very bad type, but it was getting better every year. He had seen no cases of sunstroke and only one of apoplexy.

There still lingers a little doubt on the health question, and it is intended in this section to marshal as much evidence as I have available to combat the idea that life in the Queensland tropics is subject to all kinds of climatic drawbacks.

Dr. R. W. Cilento, in "The White Man in the Tropics," says—

> "Australia has the unique distinction of having bred up during the last seventy years a large resident pure blooded white population under tropical conditions . . . . this more happy experience is directly referable to the relative absence of tropical diseases, and also of a resident native race. To the great majority of the inhabitants of temperate climates the word 'tropical' conjures up visions of sweltering mangrove flats, the haunts of the crocodile, of rank and steaming forests that exhale the musky odour of decaying vegetation, deadly snakes, &c.

> " . . . The tropical areas of Australia are unique in that they have no teeming native population riddled with disease, but are occupied by many thousands of pure blooded European settlers (103,000 along the eastern coast of Queensland alone). These settlers, some of them of the second and third generation, make up altogether the largest mass of a population purely white, settled in any part of the tropical world, and represent a huge unconscious experiment in acclimatisation, for here the white settler is not in a position as lord of a native race, but is simply a working man carrying out every occupation from the most laborious tasks to the higher grades of mental effort. . . . One of the worst features of residence in the tropics is the tendency of white immigrants to regard their period of residence as a temporary sojourn only, though this is becoming yearly less and less noticeable in Queensland where the main mass of the population is Queensland born."

Dr. Cilento quotes the following from a paper contributed by the Chief Actuary of the Australian Mutual Provident Society (C. A. Elliott), who, as the result of the examination of nearly 5,000 policies issued to adults during the years 1910 to 1919 inclusive, from the Cairns and Townsville offices, arrived at the following conclusions:—

> "The rates of mortality deduced from the inquiry were surprisingly low; the actual deaths for the period reviewed were 68, while the number of deaths expected from A.M.P. experience, 1849 to 1903, if all policies had been whole life assurances was 88, or, if endowment, 81. I have no hesitation in saying that so far as we know at present there is no need for life assurance officers to treat proponents who live in North Queensland differently from proponents who live in other parts of Australia."

The infantile mortality statistics from 1907 to 1916 proved conclusively that North Queensland compared favourably with Central and South Queensland, while it was lower than that of Victoria and Tasmania. The birth rate was lowest in Victoria, somewhat higher in Tasmania, and highest of all in Queensland.

The Australian Medical Congress passed a resolution in 1920 stating they "were unable to find anything pointing to the existence of inherent or insuperable obstacles in the way of the permanent occupation of tropical Australia by a healthy indigenous white race."

Dr. J. S. C. Elkington, Director, Division of Tropical Hygiene, Commonwealth Department of Health, in an article entitled "White Women in the Australian Tropics," stated that an extensive sociological inquiry carried out in 1924 by the Australian Institute of Tropical Medicine proved that the health of the average house-mother was good. The tropical-born baby's chances of survival are substantially better than those born in London, Switzerland, England and Wales, Canada, or Scotland, and the rest of Australia. Mentally, school children are as far advanced in the tropics as are children born elsewhere in Australia. The tropical Australian child is distinctly taller and somewhat heavier (after relative clothing weights are taken into account) than is his or her fellow-Australians of similar age in the Southern States. Dr. Elkington has personally known tropical Australia and its people for over thirty-five years, and has formed the matured opinion that it is essentially suitable for habitation by white women, their menkind, and their children to many generations.

PLATE 118.—HEALTHY TYPES OF SETTLERS IN THE INNISFAIL CANE DISTRICT OF NORTH QUEENSLAND.

Dr. Humphry, with more than thirty years' residence in the tropics, says: "Anybody who says the race will not thrive in tropical Australia is talking nonsense."

An employer, with twenty years' experience, remarks: "The British gangs head the list (i.e., efficiency and economy of labour) against all comers."

The term "British" is used to cover all white British nationalities, whether born in Australia or Great Britain.

Dr. Cilento, in another article, states—

> "The largest collection of a population entirely white anywhere within the geographical tropics exists in tropical and sub-tropical Australia, and the health of these people shows no decline from the health of people living in the cold countries, but is amongst the best in the world."

The Federal Royal Commission stated in their report that they entertained no doubt as to the possibility of effective settlement by a white population of the Queensland coastal areas. The present population is a normally healthy one, with a fully developed physique, and a low death rate. In evidence given before the Commission, the head mistress of the State school at Mossman stated—

> " . . . . the general standard of health and physical standard here are as good or better than they were in the west. . . . The attendance is better than on the Darling Downs. Only two children who have been in attendance at the school have died since I have been here (thirteen and a-half years). . . . Neither of them was born in the district."

Dr. P. H. Clarke, Government Medical Officer at Port Douglas, stated, *inter alia*—

> "cases of sunstroke were rare; that epidemics were attended by a lower mortality than in the southern portions of Australia; that, with proper care, the probability of children born in the district living to adult ages was greater than in the southern portions of Australia; that the most prevalent cases of tropical complaints were preventable."

Dr. Breinl remarked—

> "A very curious thing is that there is hardly any typhoid north of Townsville. I say that with some reservations. I have seen hardly any cases. . . . Taking the whole range of diseases that are a menace to human life and activity I should think that the North of Queensland is just about the same as the more temperate parts of the continent."

The opinion held by medical men is that the white man can lead a healthy life and rear a vigorous family in tropical Queensland provided he adapts himself to his surroundings, as regards diet and clothing, and avoids alcoholic excesses, which are debilitating in the tropics, and a fruitful cause of sickness amongst the workers in the sugar industry.

The writer of this article has had a long experience of the Queensland tropics and its population, and has never been able to detect any difference in the health of people in North Queensland and those in the Southern States. There is some difference in build and face colour—the Victorian being of stockier type and redder in the face. Football

and cricket are played in the North with the same zest as they are in the South, and hard manual work is done with the same efficiency as in the Southern States.

Mr. C. H. Wickens, the Commonwealth Government Statistician, says there has been a continuous improvement in the health of Queenslanders, and that for many years the general death rate for Queensland has been consistently lower than the average for all Australia. There was no warrant in his opinion for the theory that the reproduction of a white race in low latitudes tended to a reduction in the race of either vitality or fertility.

[TO BE CONTINUED.]

ENTOMOLOGICAL HINTS TO CANEGROWERS.

The Director of the Bureau of Sugar Experiment Stations, Mr. H. T. Easterby, has received the following Entomological Hints from Mr. E. Jarvis, Meringa:—

Remember Date of First Emergence of Cane Beetles.

Farmers will find it a good plan to make a note of the date on which greyback cockchafers first appear on the wing in cane fields. As stated last month, it seems likely that we may have an early emergence of beetles this season, as during the latter half of October numbers were ploughed up rather freely around Gordonvale.

Growers intending to fumigate their soil should keep a record of the date (or dates, if more than one) of big emergences of this insect from cane lands, as such data will serve as a guide later on as to the correct time for carrying out control work. It need scarcely be mentioned that the first swarming of greybacks usually occurs about twenty-four hours after a fall of from 3 to 4 inches of rain. If, for example, an emergence of this cockchafer (*Lepidoderma albohirtum* Waterh.) were to take place, say, on the 10th November, the following simple table would then indicate approximately the duration of its egg and grub stages of growth, and the date on which to commence soil fumigation:—

Table of Egg and Grub Stages of Greyback Cockchafer, showing Proper Time for Carrying Out Soil Fumigation.

10 Nov.—Emergence of greyback cockchafers.

24 Nov.—Beetles commence egg-laying.

6 Dec.—Hatching of grubs of first instar of growth.

Duration of first instar lasts about thirty days—6th December to 10th January.

Width of head of first-instar grubs is one-eighth of an inch.

10 Jan.—Appearance of grubs of second instar.

Duration of instar about thirty-eight days—10th January to 17th February.

Width of head of second-instar grubs is one-quarter inch.

Fumigate soil found to be grub-infested at any convenient time between the dates of about 17th February to 31st May, while the ground is nicely moist, but not in a wet condition.

17 Feb.—Appearance of grubs of the third instar.

Duration of third instar lasts approximately about sixteen weeks—17th February to 31st May.

Width of head in third-instar grubs is three-eighths of an inch.

A period of about 100 days elapses from laying of the eggs until the time to start soil fumigation.

Make Arangements for Collecting Cockchafers.

On cane areas known from past experience to be very subject to grub attack, growers should start collecting cane beetles from the foliage of feeding trees directly these insects appear on the wing.

No time should now be lost in locating the position of favourite food-plants, such as native figs, Moreton Bay Ash (*Eucalyptus tessalaris*), or others on which these cockchafers may have been seen to congregate, chancing to grow close to the headlands of their cane fields. To facilitate collecting, clear away all litter or vegetation from the surface of the ground under such trap-trees. Continue this work of collecting each day for about three weeks, dating from the beginning of the flighting period of first, second, or third emergences.

Do not be without a Spray Pump.

However small the cane farm, no grower can afford to be without the means of fighting such pests as army worms, leaf-eating caterpillars, or beetles. Such invasions are best combated at the right time—viz., when first noticed—as delay of a week or more while sending away for apparatus or chemicals often means material financial loss, which might have been avoided. For field work a knapsack pump will be found very useful on small holdings for treating army worms, &c. One having a liquid capacity of about 3½ gallons can be carried conveniently and only costs about 45s. It should be made of brass or copper, and fitted with an effective agitator and large compression cylinder, to ensure even distribution.

THE CANE-KILLING WEED.

By ARTHUR F. BELL, Pathologist; W. COTTRELL-DORMER, Assistant Pathologist.

ALTHOUGH the existence of *Striga* as a parasite of sugar-cane in Queensland has been recorded for a number of years, no detailed descriptions or illustrations have been published, with the result that the appearance and effects of the weed are still unfamiliar to most sugar farmers and technical workers in this State. Consequently, the following notes have been compiled to supplement the excellent illustrations which were executed by Mr. I. W. Helmsing under the general supervision of Mr. Henry Tryon, late Entomologist and Vegetable Pathologist in the Department of Agriculture. We are indebted to Mr. Robert Veitch, Chief Entomologist in the Department of Agriculture, for his courtesy in making available the services of Mr. Helmsing for the preparation of these plates.

History and Distribution.

These weeds are classified botanically within the genus *Striga* and are of particular interest, inasmuch as they are members of the comparatively small group of flowering plants which are parasitic upon other plants. They are fairly common throughout the tropics, occurring abundantly, according to Pearson,[5] in Tropical Africa, Egypt, Madagascar, Arabia, Ceylon, India, Siam, Java, and China. The term "cane-killing weed" is a general term applied to the members of this genus which are found parasitic upon the roots of sugar-cane in Queensland.

In South Africa one species (*Striga lutea* Lour.), commonly known as the witchweed, has been recognised as a serious parasite of the roots of maize for many years. The effects of the parasite are particularly severe if the maize is planted near the time of germination of the witchweed seeds, so that it becomes infected in the young seedling stage. The witchweed is also found as a parasite of sugar-cane in Natal, but to a much less extent than on maize.

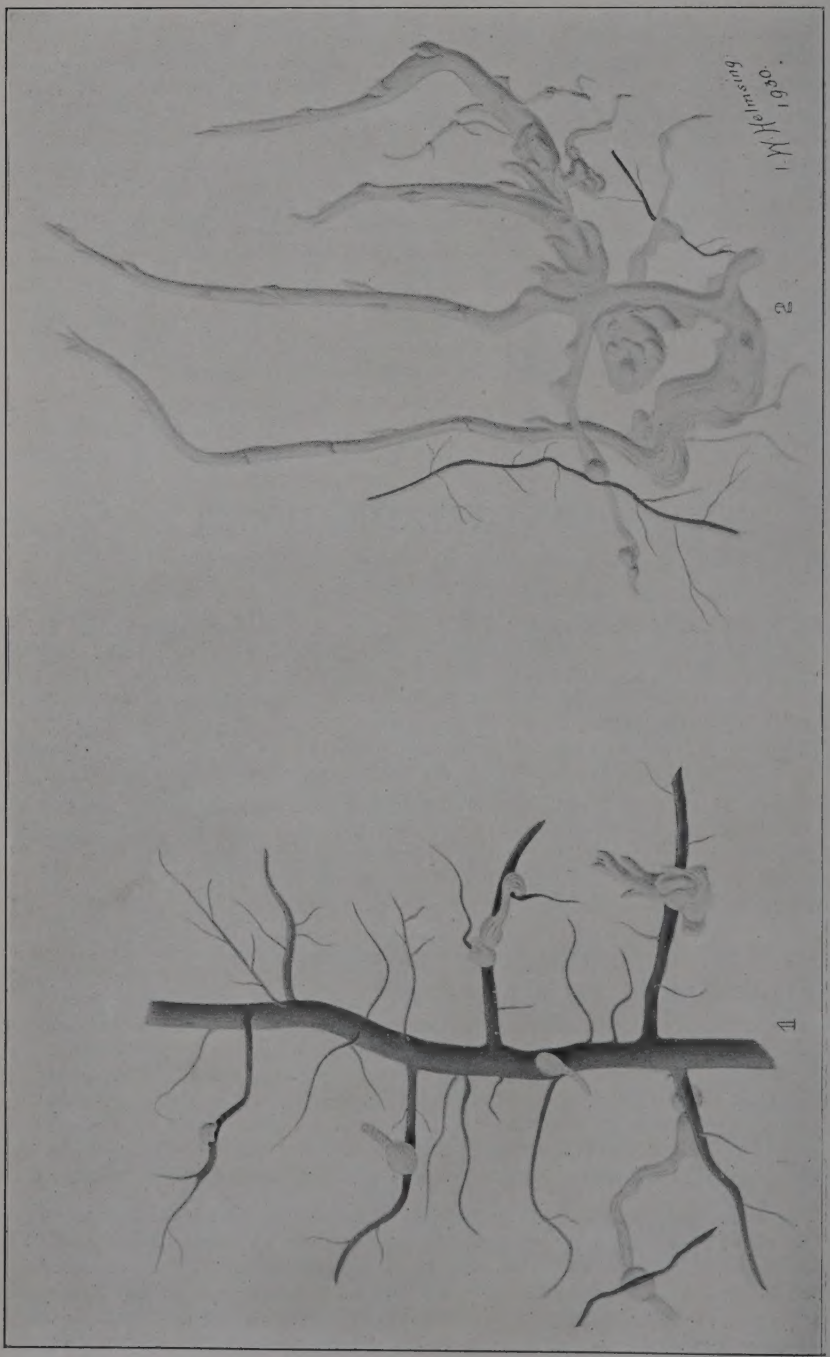

PLATE 119.

(*For description of Plate, see page 473.*)

Striga as a root parasite of cane was reported from India in 1921,[4] and was stated to have first been noticed in the Patiala State Territory about 1914. In 1920, reports were received of a new disease in the sugar-cane fields of the "Bet" lands of the river Sutlej. Upon investigation it was found that the cane roots were being attacked by flowering parasites, of which two were observed—namely, *Striga densiflora* Benth. and *Striga euphrasioides* Benth. In the course of the investigation, it was found that the parasite disappeared when the fields were rotated to cotton, and that therefore partial control had been unconsciously practised in the past.

This parasite is also found on sugar-cane in Mauritius, and in 1928 *Striga hirsuta* was reported as causing considerable damage on one estate.[6]

Specimens of *Striga* spp. were collected early in the botanical history of Queensland, and *S. hirsuta*, *S. parviflora*, and *S. curviflora* were included in an early catalogue of plants,[2] at which time they appeared to be generally distributed over the State. The first record of these plants as parasites of cane appears to have been in 1916, when Tryon[7] briefly reported *S. parviflora* as attacking cane in the Degilbo district. In 1924, the weed was found independently by Cottrell-Dormer at Carmila.[2] Since that time at least three varieties or species of the weed have been found in various parts of the Burdekin, Proserpine, Mackay, and Bundaberg districts.

We have, on several occasions, found the weeds associated with wild grasses, but in no case was any apparent stunting produced. They, therefore, are an example of indigenous parasites which have established a state of equilibrium with their hosts, but the state of equilibrium has now been disturbed by the introduction of a new cultivated host plant which has proved susceptible and allowed the parasites to gain the ascendency.

Appearance of the Disease.

As a rule the areas of infection are roughly circular in shape, with a diameter of a few yards. The damage to the crop may range from an almost imperceptible stunting, in the case of very light infection, to the premature death of the cane. In a typical case the stools are markedly stunted, with small sparse tops and clinging trash. The stunted green leaves stand out stiffly from the crown and the more recently dead leaves tend to stand out at an angle rather than hang loosely. As a result, the leaf blades present an appearance similar to the spokes of a wheel. The older leaves hang stiffly down the stalk. In common with most root diseases, the symptoms produced in the cane by these parasites are not particularly definite. The clinging trash may be responsible for the shooting of the aerial roots, but even in the recently dead canes there are no visible symptoms such as reddened fibres, &c. The root system does not appear to be reduced to any appreciable extent.

During the summer months the small weeds may readily be found in clusters at or near the base of the stools, while in some cases they may be generally distributed in the interspaces also. If a stool and the associated weeds are dug up and the soil carefully washed away, the white roots of the parasite will readily be distinguished from the dark-brown roots of the cane. Both sets of roots are much intertwined, and on careful examination it will be seen that the roots of the parasite are

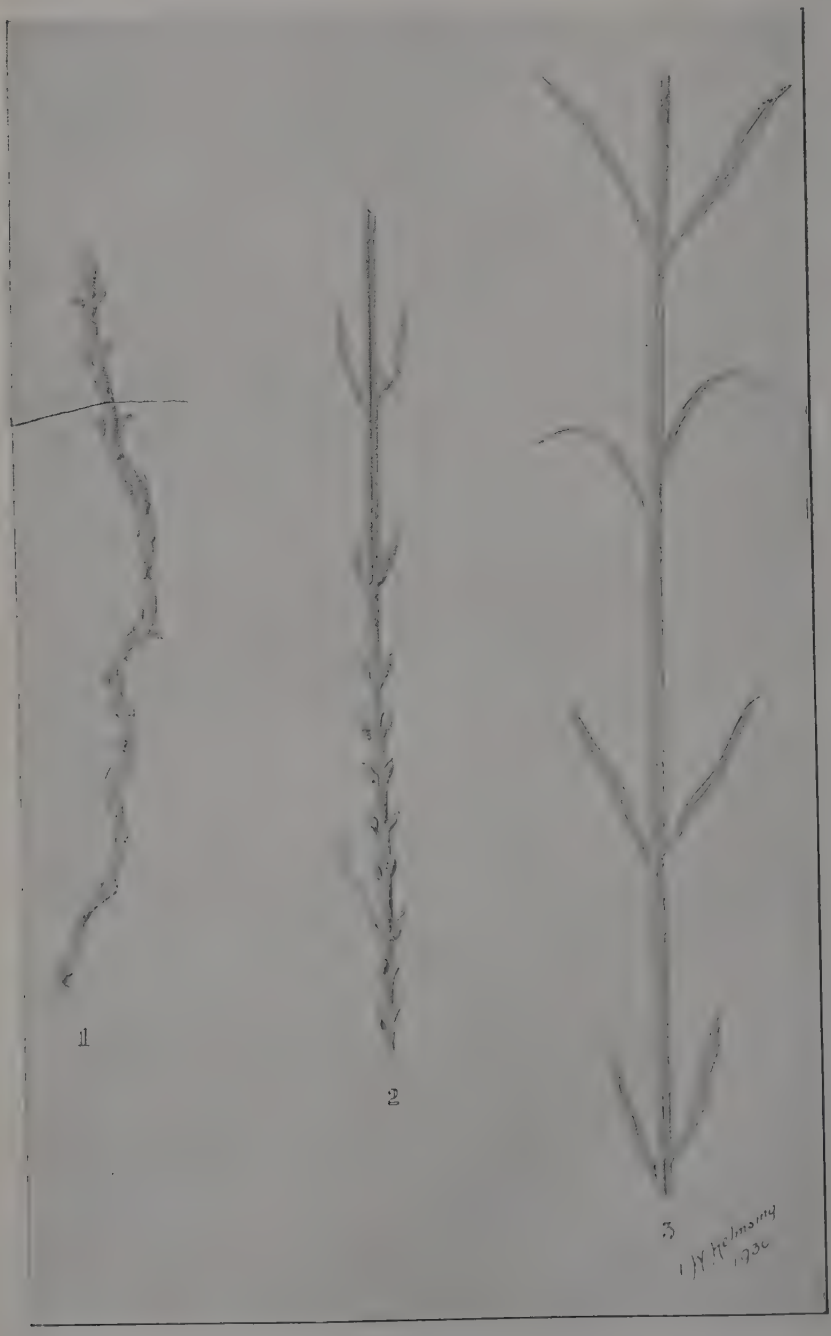

PLATE 120.

(*For description of Plate, see page* 473.)

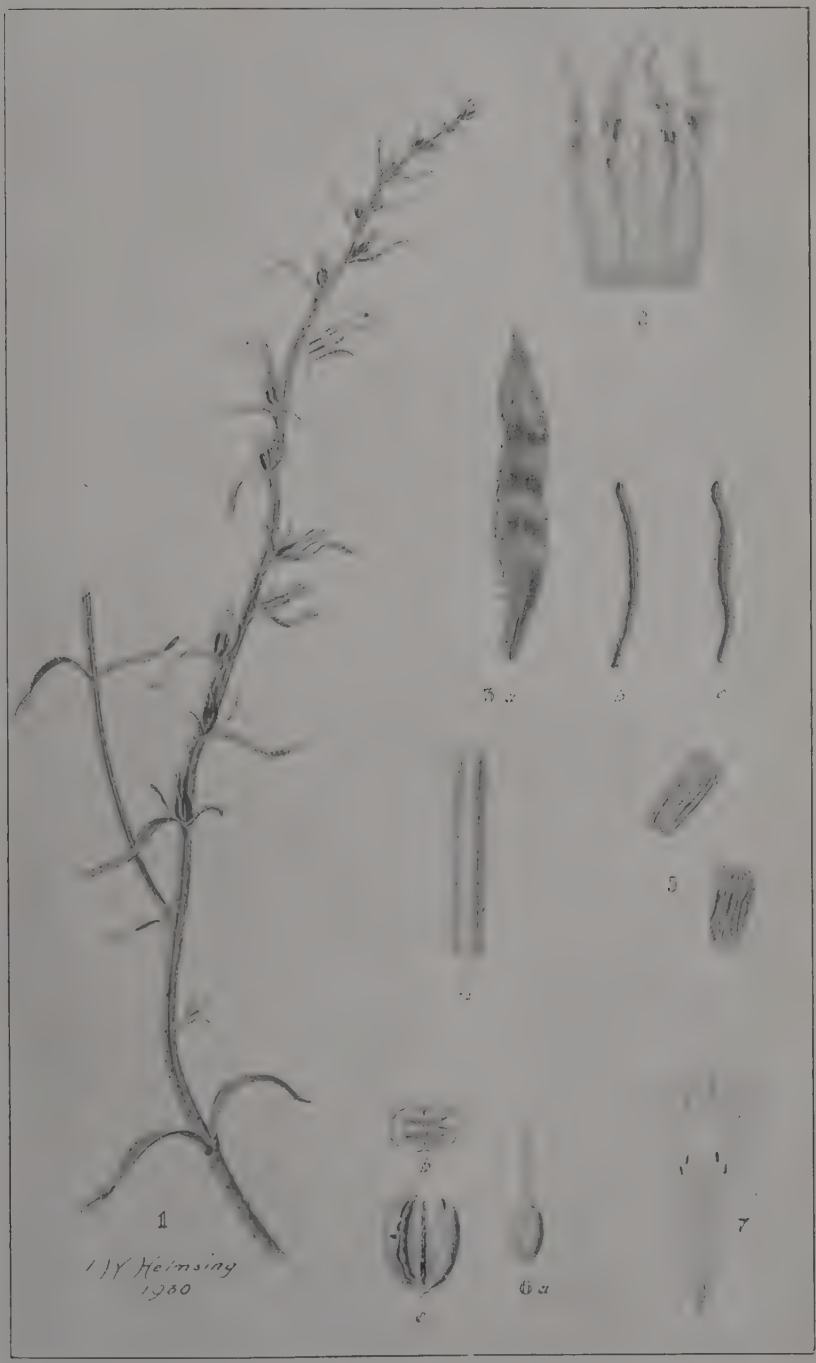

PLATE 121.

(*For description of Plate, see page* 473.)

attached to those of the cane by means of small cup-like swellings. The number of such attachments per weed may vary from one to many.

After the death of the weeds in the autumn a careful search may be necessary before the dried bluish black plants may be found.

Description of the Parasites.

The following botanical description of the genus *Striga*, to which these weeds belong, is taken from Hooker[3]:—

"Usually scabrid herbs, discoloured or black when dry. Leaves, lower opposite, upper alternate, linear, entire, rarely toothed, sometimes reduced to scales. Flowers axillary or the upper in bracteate spikes, often 2-bracteolate. Calyx tubular, strongly 5-15 ribbed, 5-toothed or -fid. Corolla-tube slender, abruptly incurved at or about the middle or top; limb spreading, 2-lipped, upper lip usually short notched or 2-fid; lower, the inner in bud, 3-fid. Stamens 4, didynamous, included; anthers 1-celled, vertical, dorsifixed, bases obtuse, connective sometimes mucronate. Style thickened above, stigma simple. Capsule subglobose or oblong, loculicidal; valves entire, septiferous, separating from the placentas. Seeds very numerous, ovoid or oblong, reticulated. Species about 18, in the hotter regions of the Old World."

As stated above, at least three distinct weeds have been found parasitic on cane in Queensland, but owing to the rather ill-defined differences between some of the recorded species, and in the absence of type specimens, we have not attempted to identify them. The chief differences are in flower colour and habit, viz.:—

(*a*) Erect, flowers light-blue or lilac.

(*b*) Trailing on ground, flowers light-pink.

(*c*) Erect, flowers light-pink.

The general characteristics of the weeds may be studied in detail by references to Plates 119 to 124. The above-ground stems are green, circular at the base, but becoming quadrified higher up (Plate 120, figs. 2 and 3; Plate 121, fig. 4). The leaves are small, elongated, and green, the lower leaves being opposite and the upper alternate. Both stem and leaves become bluish black in colour when dried. Flowering takes place freely during the late summer; the flowers are small, sessile, and borne in the form of long interrupted spikes. The seeds are borne in small cylindrical capsules (Plate 121, fig. 6) which split longitudinally and liberate their contents. The seeds are very small (about one thirty-second of an inch long), light, and are produced in extremely large numbers. The underground portions of the stem are white, fleshy, and branched, and bear whitish scale-like leaves (Plate 119, fig. 2); the roots are light-coloured and much branched and the rootlets bear root hairs, although these are not present in large numbers.

The complete details of the life history of these parasites are not available, but, according to Pearson,[4] it is essentially as follows:—The seed falls upon the ground in late autumn or early winter and remains dormant until the early spring, when it germinates. The root of the young seedling grows out and produces small whitish spherical bodies, or haustoria; when the root comes in contact with a root of the host plant it becomes affixed thereto by these haustoria (Plate 119), which then send forth outgrowths which burst through the outer layers of the

PLATE 122.

(For description of Plate, see page 473.)

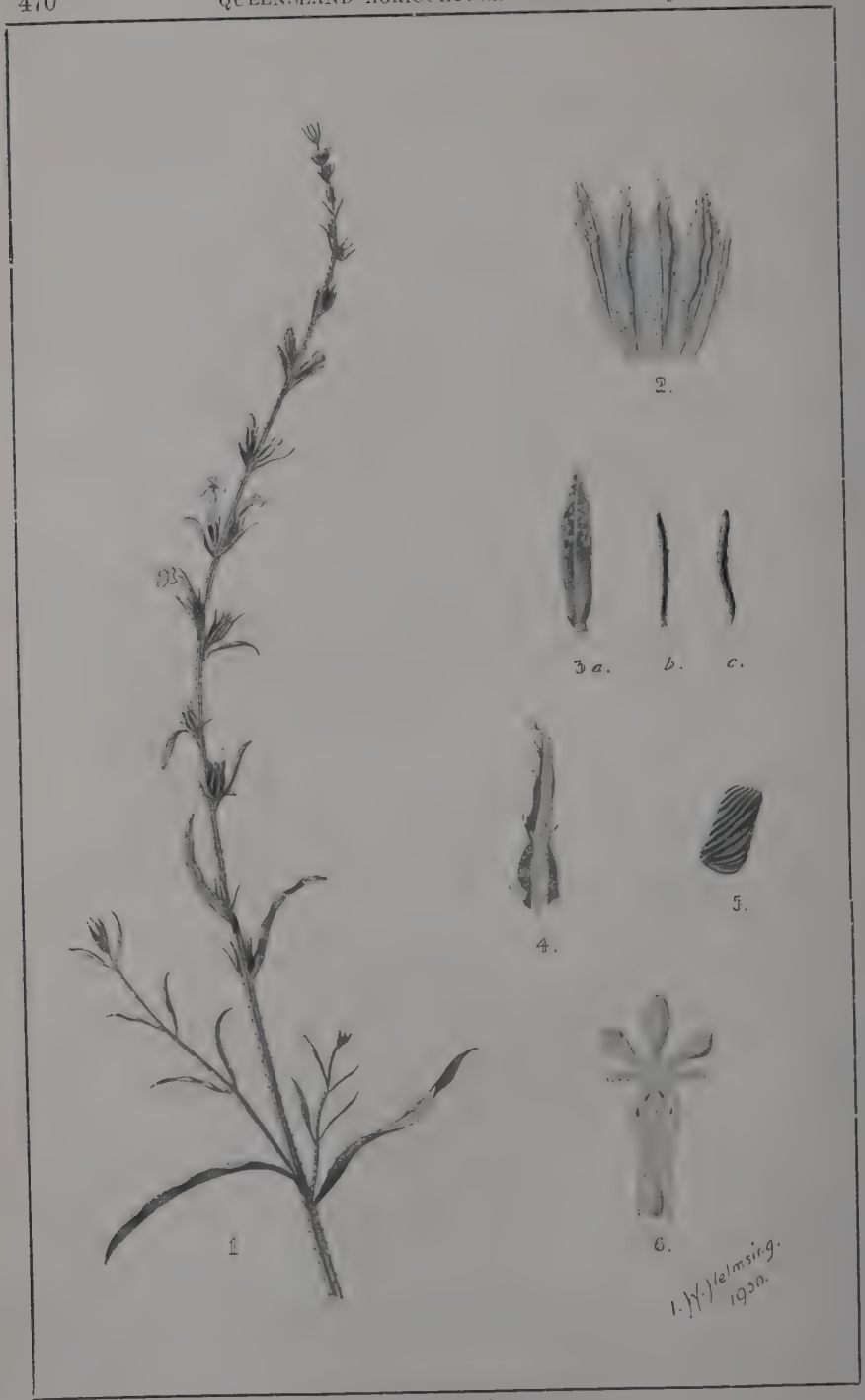

PLATE 123.

(For description of Plate, see page 473.)

root and penetrate to the vascular system. On examination of a section cut through both root and haustorium the vascular bundles of the parasite may be traced through the haustorium and outgrowths into the vascular system of the cane root, thus forming a continuous vascular system between host and parasite. In the first few weeks of its existence the parasite does not appear above ground and the leaves remain whitish and rudimentary, but once the aerial stalks appear above ground their subsequent growth is rapid.

Since the leaves are green, it follows that this parasite must be able to carry on photosynthesis during the above-ground period of its existence, and the presence of some root hairs would enable it to absorb a certain amount of water and plant foods from the soil as well as from the roots of the host plant. It must therefore be classed as a semi-parasite, at least during the later period of its existence. It is generally assumed [4 and 5] that the stunting of the cane plant is due to the loss of water and plant foods sustained by the host, but we have frequently seen cane stools 3 feet high killed by a small number of weeds the total dry weight of which would not exceed that of one or two cane leaves. In a recent outbreak on the Burdekin, in which this condition was observed, the cane had been grown under regular irrigation and had suffered no check in growth. The remainder of the field yielded 45 tons per acre, for a one-year crop, while in a patch several yards in diameter the cane had been killed when about 3 feet high. We are therefore inclined to the view that the weed must elaborate some substance toxic

Transmission and Control.

The cane-killing weed is an annual and the whole plant dies after flowering and the production of seed. It is propagated by means of these seeds, which, being small and light, are easily carried by the wind and drainage and irrigation water.

Owing to their intimate association it follows that any practice, such as poisoning, which will kill the parasite is also likely to kill the cane. If the total area attacked is not large, every effort should be made to prevent the weeds from flowering and setting seed which will infect the next year's crop. This may be effected by chipping, but owing to the fact that the underground stems are constantly sending up fresh aerial shoots it is necessary to inspect frequently and chip when required. The seeds are sensitive to heat, and the burning of trash will assist in killing all seeds above or near the surface of the ground. Where the crop is heavily infected, it is recommended that it should be ploughed out and the ground rotated to legumes, which are not attacked. Under these conditions no fresh seed will be set in that season and few, if any, of the previous season's seed may be expected to survive.

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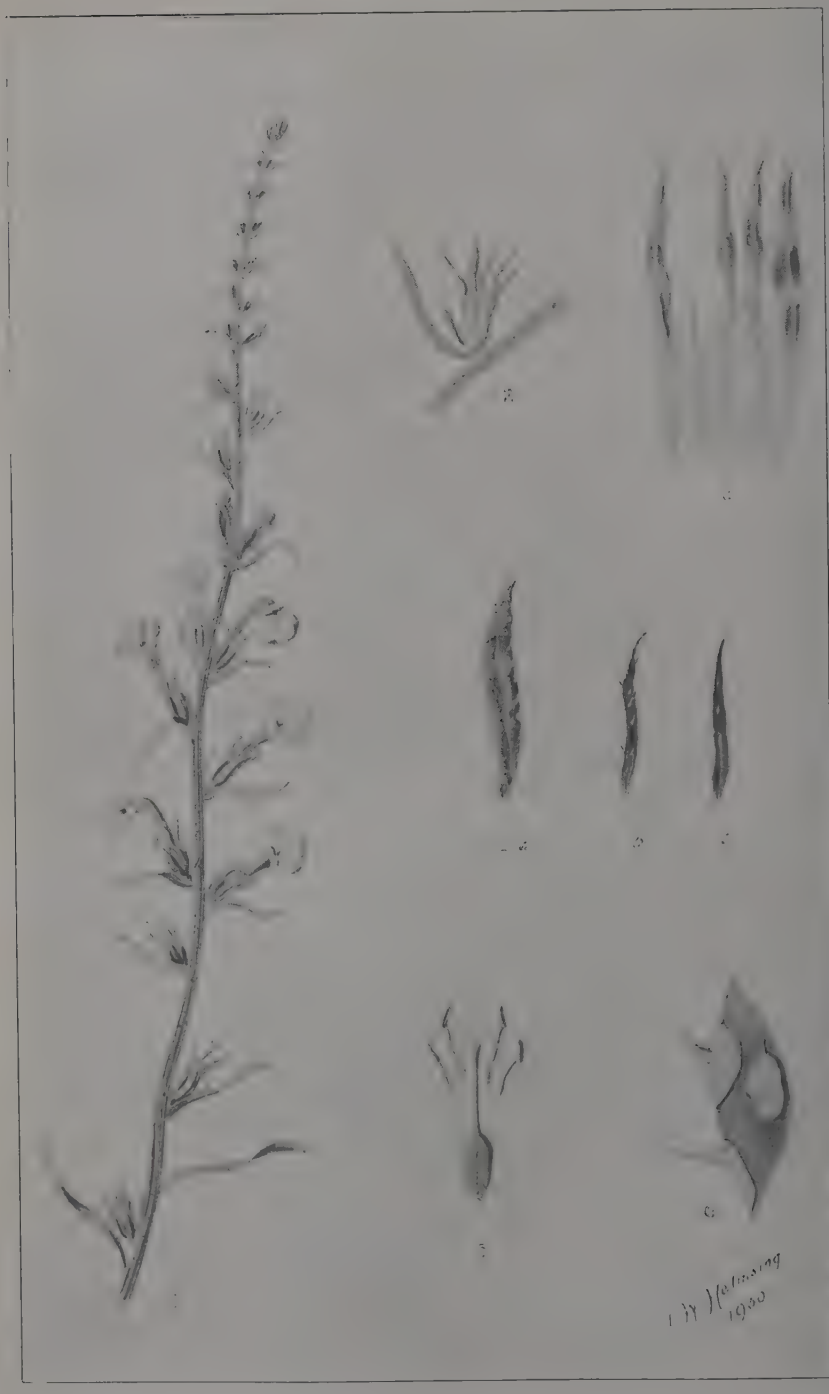

PLATE 124.

(*For description of Plate, see page* 473.)

DESCRIPTION OF PLATES.

Plate 119.

Fig. 1.—Young seedlings attached to the roots of the host plant by means of small cup-shaped haustoria.

Fig. 2.—Parasite during underground period of existence. Note white fleshy stems, rudimentary leaves, and light coloured roots attached by means of haustoria to the dark sugar-cane roots, x 2.

Plate 120.

Fig. 1.—Underground stem. Natural size.

Fig. 2.—Junction of underground and aerial stems; the latter is green, round, and bears elongated green leaves. Natural size.

Fig. 3.—Upper portion of aerial stem, the stem is now quadrifid and the leaves alternate. Natural size.

Plate 121.

Specimen from Bundaberg; habit erect, flowers light-pink.

Fig. 1.—Inflorescence. Natural size.

Fig. 2.—Calyx, x 4.

Fig. 3.—a. Bract, b. & c. bracteoles, x 4.

Fig. 4.—Portion of upper stem showing quadrifid nature.

Fig. 5.—Seeds, x 17.

Fig. 6.—a. capsule, x 2; b. cross section of capsule, x 4; c. empty capsule after splitting longitudinally and liberating the seeds, x 4.

Fig. 7.—Flower, dissected to show arrangement of floral parts, x 3.

Plate 122.

Specimen from Mackay; habit erect, flowers light-blue.

Fig. 1.—Inflorescence. Natural size.

Fig. 2.—Calyx, x 4.

Fig. 3.—a. bract; b and c. bracteoles, x 4.

Fig. 4.—Flower bud, x $2\frac{1}{2}$.

Fig. 5.—Flower dissected to show arrangement of floral parts, x 3.

Fig. 6.—Seed, x 17.

Plate 123.

Specimen from Proserpine; habit erect, flowers light-blue.

Fig. 1.—Inflorescence. Natural size.

Fig. 2.—Calyx, x 4.

Fig. 3.—a. bract; b and c. bracteoles, x 4.

Fig. 4.—Extremity of tooth of calyx. Enlarged.

Fig. 5.—Seed, x 17.

Fig. 6.—Flower dissected to show arrangement of floral parts.

Plate 124.

Specimen from Burdekin; habit trailing, flower light-pink.

Fig. 1.—Inflorescence. Natural size.

Fig. 2.—Calyx, bract, and bracteoles, in situ, x 2.

Fig. 3.—Calyx, x 4.

Fig. 4.—a. bract; b and c. bracteoles, x 4.

Fig. 5.—Arrangement of floral parts, x 2.

Fig. 6.—Protective appendages on margin of bract. Greatly magnified.

GRASS PESTS OF THE ATHERTON TABLELAND.

By D. O. ATHERTON, B.Sc., Entomological Branch.

FOR the past ten years spasmodic reports of insects injuring pastures on the Atherton Tableland have been received by different officers of the Department of Agriculture and Stock, but not until 1929 did the urgent nature of the problem become apparent. Early in 1921, A. P. Dodd, then of the Bureau of Sugar Experiment Stations, reported a species which resembled cane grubs as a pest of the grass lands near Atherton. Damage to paspalum paddocks by white grubs was reported to this Department in 1927.

Also in 1921 Dodd reported the larva of *Oncopera mitocera* Turn. as a pest in paspalum pastures on the Tableland. From that time to the inception of the present investigation, this species has not been reported as a serious pest in the area, but an allied species, *O. intricata* Walk., has for many years past been actively destroying cocksfoot pastures in Tasmania.

Early in 1930, J. Harold Smith, the entomologist of the Department of Agriculture and Stock in charge of the Cairns Field Station, was able to report that those farms which had suffered severely from the attacks of the white grubs during the previous year showed signs of almost complete recovery. The appointment of the writer as an assistant to the Cairns office in the same year promoted the inception of a more complete survey than had hitherto been possible, and the present paper collates the information so far available.

Insects Involved.

The species concerned are active in their larval stages as pests of pastures, and they fall into two distinct groups—the white grubs, family Scarabeidæ, and the grass grubs, family Hepialidæ. There are a number of species in the former group, and, according to Dr. Jefferis Turner, two, perhaps three, in the latter. In the case of the white grubs, the whole of the larval life is spent in the soil, whereas the grass grubs shelter in tunnels therein, but emerge to feed on the selected host plants. Each of the two groups of insects thus enjoys a certain but different measure of protection from natural enemies. There is a great difference in the mode of injury; the Hepialids feed on the flaggy parts of the grass, while the Scarabeids feed on the roots below ground level. It would appear that all the species involved are indigenous to the rain forests of the area, feeding on pasture grasses being an acquired habit evolved to meet the changed conditions initiated with the felling of forests for dairying purposes.

WHITE GRUBS.

Many scarabeids are classed as white grubs by the lay mind, but only a few are known to definitely injure pastures, while the remainder do no apparent harm. Of the injurious species, two concern the Tableland farmer. One, *Lepidiota caudata*, is common round about Malanda, while the other is responsible for pasture losses in and around Atherton. The latter insect is at present unnamed, and in the early larval stages is difficult to separate from *L. caudata*, though the adults are quite distinct.

The regional limits of each require working out in detail, but the generalisation already made is sufficiently definite for ordinary purposes.

Of the non-injurious species, *Dasygnathus australis* Boisd. is common in Tableland pastures, while *Neso flavipennis* Macl. has been collected on six farms. Heteronyx and some four or five other species occur in small numbers, but never in circumstances which would associate them with pasture destruction.

All the identifications have been based on larval characters in the first instance, later supplemented by collections of the adults during the flight season in the case of the two principal pests. Where such confirmation is wanting, the characters of the larval head and anal tract are taken to be sufficiently distinct to allow specific reference.

The life histories of the two white grub pests are very similar, and for the purposes of this discussion *Lepidiota caudata* is considered in some detail.

Lepidiota caudata Blackb.

Injury.

This species is very probably indigenous to the Tableland and considerable numbers may exist in a pasture before being noticed. Field symptoms normally appear during the autumn and winter, when the grass is less vigorous than at other times of the year. Injury takes the form of roughly circular patches which gradually extend in area, the grass becoming brown and finally dying out. In a typically severe case the patches extend until as much as 90 per cent. of the field may be affected, but in lesser attacks the damage is often localised to the vicinity of old logs and stumps which encumber the ground. The flight habits of the beetle may cause this phenomenon, for adults on the wing strike the obstruction, fall to the ground, and lay their eggs on the spot. In heavily infested pastures, the soil becomes wholly granulated, for, when feeding, the larvæ pass soil through the alimentary canal and void it in small pellets. As many as 146 larvæ have been taken less than 6 inches deep over an area of 1 square yard. In such a case, the grass is destroyed and can be raked from the surface with the fingers.

Life History.

According to Dodd, *L. caudata* has a two-year life cycle, comparable to that of *L. frenchi* Blackb., a cane pest of some importance. The adult beetles, dark-brown in colour, are on the wing during the early weeks of the wet season and apparently lay their eggs in isolated places, for outbreaks usually commence at various centres in the one paddock and spread as the food requirements of the young necessitate. Unless the population is considerable, pasture destruction is not apparent until the second year of larval life, when the appetite of the insect is voracious. The growing larval stage is completed in September of the second year and is succeeded by pupation at a considerable depth in the soil. Pupation may last two or three months, the period being determined by the advent of the summer rains, which have considerable influence on the emergence of the adult.

Distribution and Bionomics.

Damage by white grubs would appear to be confined to the older pastures of the Tableland. All cases in which *L. caudata* is the harmful agent have been pastures of at least fifteen years' standing. The one

farm on which a younger pasture has suffered was but ten years old when the first sign of the white grub trouble was noticed by the farmer, but there is some doubt here concerning the identity of the pest.

The influence of the aspect of the pasture or its proximity to primeval rain forest on white grub infestation is almost unknown. It is just possible, however, that land swept by prevailing winds passing over rain forests is slightly more susceptible to the pest. Presuming the prevailing wind to be from the south-east, those fields with a south-east aspect may be more likely to stop the flight and receive the eggs of the gravid females. These are mere presumptions, however, for which there is little evidence. It is uncertain that beetles make long flights, and the suggestions do nothing more than indicate the problems which may be better explained by subsequently disclosed facts.

Plant Succession in Damaged Pastures.

When a stand of grass has been weakened through any cause whatever, other plants tend to make their appearance. A very striking illustration of such a succession was observed in a field showing the symptoms of white grub infestation. The paspalum in the bulk of the field was an almost pure stand, isolated plants of *Cnicus lanceolatus* (Scotch Thistle) and flannel weed being the only weeds. The distinctively brown patches were accentuated by a much more varied flora, including *Ageratum conyzoides* (Goat weed), *Tagetes glandulifera* (Stinking Rodger), *Acanthospermum hispidum* (Star Burr), *Sida* spp., *Oxalis corniculata* (Sour grass), and *Sporobilis indicus* (Rat's tail grass) in addition to the two previously mentioned. A more advanced stage was seen in another field which when examined had been isolated from stock for six to eight months, and two years before was badly infested with white grubs. *Tagetes glandulifera* and *Solanum auriculatum* (Wild Tobacco) were the dominant species, while occasional seedlings of *Amelia composita* (White Cedar) were just beginning to make their appearance. The latter field was well on its way to reclamation by the original rain forest formation.

The above is an extreme example, as, in most cases, succession is neither so rapid nor complete. Weeds are very likely to be of some importance in the decline of pastures initiated by white grubs, but they are readily overcome by a healthy pasture.

In addition to the foregoing, a number of species are met with more or less regularly, viz., grasses—*Paspalum platycaule* (Buffalo couch), *P. conjugatum* (Yellow grass), *Cynodon dactylon* (Couch grass), *Eleusine indica* (Crowsfoot grass), *Panicum sanguinale* (Summer grass), *Paspalum galmarra* (Russell River grass); and weeds—*Malvastrum tricuspidatum*, *Phytolacca octandra* (Ink weed), *Bidens pilosa* (Cobblers' pegs), *Amaranthus spinosus* (Needle burr), *Euphorbia pilulifera* (Asthma plant), *Richardsonia scabra* (White eye), *Triumfetta rhomboidea* (Chinese burr), and *Verbena officinalis* (common vervain).

Natural Recovery.

In some circumstances pastures which have been seriously affected with the white grub pest are able to recover, even though subjected to heavy stocking. There are paddocks on at least three farms where this has occurred. In each the paddocks were denuded of grass during the dry weather of the years 1928 and 1929. The soil was in a granulated

condition and stock or people walking across the land sank through the crust to a depth of several inches. Stock have since been running on each of the fields continually, yet during the months of July and August, 1930, there was good feed on all. However, the ground still showed an uneven surface caused by grazing stock during the months of infestation. In the opinion of some of the farmers, the thorough granulation of the soil following white grub infestation has had a beneficial effect in promoting the growth of healthy and more vigorous pastures.

Natural Controls.

The fact that the larvæ are confined to the soil, as previously mentioned, militates against any great measure of control by natural enemies. Nevertheless, there are a number of agents which exert some restriction on the indefinite increase of the pest. These include—

(*a*) Other Insects.—The entomologists of the Bureau of Sugar Experiment Stations noted that wasps of the family Scoliidæ attack cane grubs, and it seemed reasonable to suppose that they also parasitise white grubs in pastures. There is, however, no evidence to support this, though adults have been seen on the wing occasionally. Large numbers of grubs were handled in the course of this work, but no signs of parasitism by Scoliids or any other insects were found.

(*b*) Pathological Disorders.—Occasionally larvæ when collected are blackened and flaccid with disease. On one farm the number of such diseased specimens reached 4·2 per cent.

(*c*) Animal Predators.—Some farmers contend that bandicoots prey actively on white grubs, but the value of these marsupials in reducing the white grub population must be regarded as slight. The black ibis is certainly an active enemy. Thus in one field twenty-three birds were spread over some 4 square chains scratching through the dead grass and feeding on the grubs. Brolgas or native companions also feed voraciously on the grubs in a similar manner to the ibis. Unfortunately, the good work of both birds comes at a time when the pasture has been almost entirely destroyed, hence their usefulness is confined to a depletion of the potential beetle fauna which the grub population represents.

(*d*) Climate and Weather.—There is no evidence to show that mild frosts such as occur on the Tableland have any influence on the severity of grub infestation. Heavy rains sometimes depopulate certain low-lying areas, for should the soil be saturated for some days, the grubs are forced out of the soil and are drowned. Good winter rains are indirectly beneficial, for the increased vigour of the grass helps pastures to overcome any setback due to the partial destruction of their root systems by the grubs.

Practical Remedies.

Owing to the habits of the larvæ, the only possible means of applying an insecticide would be as a soil fumigant. This method is both impracticable and uneconomic for the treatment of pastures, hence attention could be better given to the utility of biological control and cultural practices. There is little information available about the former, but changes in cultural practices have already been effected by several farmers.

Throughout the area, it is customary to give no further attention to the paspalum pasture once the turf is established, yet its stock-carrying

capacity is expected to remain consistently high. Actually it deteriorates fairly rapidly, and two common evils—over-stocking and continuous stocking—hasten the process, quite apart from the effect of occasional white grub infestation. There is some evidence to show that a periodic spelling of the paddock has a beneficial effect. Thus several properties, practically denuded of grass in 1929, carried a very healthy and substantial body of feed the following year, the result of resting the paddock for several months.

A number of men have advocated the cultivation and breaking up of the matted paspalum roots as a remedial measure. Some have used a special tine cultivator, but most merely turn the land over with the plough late in the year. In either case the method entails a certain amount of expenditure in clearing the land of any logs or stumps. Cultivation is generally feasible on the inside—i.e., the country north and west of Malanda—but the majority of the farms in the districts about Tarzali and Millaa Millaa are on broken country where such measures would be impracticable. The majority of the farms which have been cultivated were first worked only two or three years ago and, for the most part, the results are quite satisfactory. When cultivation is proposed, it is advisable to work the land during the storm season in November and December. The plants will then readily strike root and a new pasture cover will be available within a few months. Such pastures should only be lightly stocked until the first flush of grass has shed its seed and the sward is tolerably complete.

Another cultural method adopted by one or two men takes the form of grazing pigs on grubby land following the American practice of hogging off on maize lands infested with white grubs. This procedure has much to recommend it. The pigs tear up the ground and thus loosen and aerate the soil, at the same time disturbing the root-bound condition of the paspalum; they feed on the white grubs, thus destroying a potential brood of beetles, while this addition to their diet conditions the animals very rapidly.

GRASS GRUBS.

So far as the present inquiry goes, there appears to be but one species involved, though Dr. Jefferis Turner says that there are at least two, and probably three, moths of the genus *Oncopera* recorded from the districts concerned.

Oncopera mitocera Turner.

The advent of this species as a pest to the Tableland was described by Dodd in 1921, and, unfortunately, it appears that little can be added, at this juncture, to what he has already written.

Injury.

The leaf blades and stems of the grasses are eaten by the larvæ and the surrounding earth littered with frass: this latter condition is very distinctive. During a heavy infestation the ground is practically bared by this scourge, and patches several square yards in area are totally denuded of grass. Damage is likely to occur at any time of the year, though when it comes in the winter months the position is made more serious owing to the seasonal shortage of feed common at that time. The same farm may suffer year after year, and the effect on the output is consequently severe. Paspalum pastures are held by some farmers to

become more susceptible to *Oncopera* attack when allowed by spelling to produce a long flaggy growth a foot or more in height. This view possibly depends on the fact that the larvæ of *Oncopera* cut away the stem of the grass at ground level and the top quickly dries up—emphasising the activity of the pest and its mode of operation. The grass may then be raked off the surface and the ground below is found to be bare save for pieces of rotting grass and the frass of the marauder.

Life History and Habits.

Moths are on the wing in large numbers between the months of January and April. Eggs are distributed freely among the grass, and larvæ may be collected from July to December, and then vary in length to a maximum of over 2 inches. Pupation takes place in the larval burrow from December to March at a depth of 4 to 6 inches.

In the later instars, the larvæ are very different from those of the earlier instars, not only in size but also in structure and in the depth of colouring. Whereas in the early stages the anterior surface of the head presents a decidedly flat appearance and is bounded round the antero-lateral edges and vertex by a continuous semi-circular ridge, the older larvæ have the head normal and convex in its anterior aspect, without lateral regions or vertex ridged. Later instars are very much lighter in colour, with head and thorax light-brown and abdomen very light-green or creamy; early instars have head and thoracic sclerites black and abdomen dark-green.

The more or less vertical burrows excavated by the grubs may be from less than 6 inches to more than 15 inches in depth, the last 3 or 4 inches being unlined with silk. The larvæ may construct a chamber in the burrow just below the surface of the ground which possibly facilitates turning when excavations are in progress. The soil is apparently collected from the base of the extending burrow and held in the mouth-parts as the larva backs into the chamber, in which it turns before carrying the burden outside. Burrows constructed on pasture land, particularly in situations where the grass is short, are frequently left unprotected at the surface. In many cases where the grubs are sufficiently numerous to be regarded as pests, the silk lining of the burrow merely projected some ¼ inch or ½ inch above the surface of the ground. The top inch of the burrow was very often inclined away from the vertical and, if on a slope, usually faced down the hill. It is commonly found that in pastures with a fairly long growth, anything from 3 inches upwards, the larva builds a sort of anteroom over its burrow. Here the usual burrow is brought to within ½ inch of the surface and there flared out like the top of a test tube. Built over the top of this was a covering consisting of pieces of earth and dead grass. The cavity is about 1 inch to 1½ inch long and two-thirds this distance in width. This little hollow below the burrow opening is usually filled with frass and feeding reserves. The whole of the cavity is lined with silk, and a passage-way of similar material leads away from it in a horizontal direction. Despite careful search in the rain forest for an analogous structure, no trace of such has been found, and it appears to be therefore peculiar to pastures with a fairly heavy sward.

An average of twenty to twenty-five burrows per square foot was found to be common in a heavily infested area and, under such conditions, it is not unusual for the ground to be bared of grass.

Larvæ in the rain forest live in burrows with unprotected entrances. Here they feed on fallen leaves, in particular those of the strangling fig (probably *Ficus Watkinsonii*). These fallen leaves, though yellow to some extent, are usually succulent for some time after they fall to the ground; but dry leaves and even soft wood may be taken by the insect.

Distribution and Bionomics.

This is most certainly an indigenous species in the local rain forests and may be found, though not always as a pest, on almost any holding from Yungaburra to Evelyn. Eight to ten years ago it was commonly found as a pest of paspalum round about Yungaburra from Kutara to Kureen. Now, however, it does not cause the farmers serious worry outside the Millaa Millaa district. Reports of severe damage by *Oncopera* were received from six only of the farms visited during the past two years, but the pest has been located on many others in various parishes from Yungaburra to Evelyn. Eight to ten years ago it was commonly in the vicinity of affected pastures.

These grass grubs have been taken on pastures of widely different ages, varying from six to eighteen years. Those farms on which the infestation has been very bad during recent years are on the edge of a large tract of rain forest which clothes the Cardwell Range between Ravenshoe and Millaa Millaa. There seems to be abundant evidence to show that damage from *Oncopera* grubs is intimately related to the mutual proximity of farm lands and unfelled rain forest.

Practically all grasses in the more recently established pastures, whether these be intentionally or unintentionally present, are attacked by the grubs. The more favoured ones include *Pennisetum clandestinum* (Kikuyu grass), *Paspalum platycaule* (Buffalo couch), *P. dilatatum* (Paspalum grass), and *P. conjugatum* (Yellow grass). In one field where all these grasses but the last were growing, *P. platycaule* suffered most severely, but there appears to be no consistent preference for any one grass.

Succession and Natural Recovery.

Oncopera-attacked pastures rarely show the floral succession described in the white grub discussion, though chickweed may flourish in the region of logs and scrub boundaries where the pest has been operating.

If the pest attacks a pasture year after year, the root system of the grasses apparently suffers. On one property which had been grassed for twelve years, and which had been attacked for the past six years, there was no root-bound condition such as would normally characterise a pasture of that age. It is presumed that the proliferation of new shoots following *Oncopera* attacks so drains the vitality of the plants that normal development of the root system is partly inhibited. In cases where there has been no *Oncopera* attacks for some years, even though previous attacks have been severe (there are a number of such farms in the Peeramon district), there is no apparent residual effect on the pasture. Once the infestation ceases to be noticeable, the grass recovers quite rapidly and there appear to be no harmful after-effects.

Natural Controls and Practical Remedies.

There has been no evidence to show that either parasites or micro-organisms are active as controlling agents. Various native birds probably feed on the grubs and moths to some extent. Local opinion asserts that

the common black ibis is a beneficial factor in the decimation of grass grubs, the birds reaching the grubs in their burrows by the insertion of their beaks. Floods and heavy rains are also held to account for large numbers of grubs which would otherwise reach maturity.

As yet no practical measure for dealing with the pest has been devised. It seems unlikely, judging from the absence of success in Tasmania against *O. intricata*, that insecticides will prove of material value. The trouble is apparently bound up with the proximity of rain forests to the farms, and it is hoped that as development on the Tableland proceeds the losses to dairying due to this cause will be materially reduced.

Conclusion.

It is hoped that this report will serve as a reasonably accurate statement of the present position regarding the two major grass pests on the Atherton Tableland. Both grass grubs and white grubs have caused justifiable concern to many farmers, and it is hoped that improved cultural methods and better pasture management will help to counter the losses which would otherwise be inescapable.

SUMMARY.

For the past ten years, intermittent reports of spasmodic outbreaks of insect pests in the pastures of the Atherton Tableland have been received by the Department of Agriculture and Stock. These indicated fairly widespread damage in 1928 and 1929. The insects involve two groups—white grubs or species of Scarabeidæ, and grass grubs or species of Hepialidæ. Of the white grubs, *Lepidiota caudata* Blackb. appears to be the only important pest near Malanda, while a second unidentified species attacks pastures at Atherton. The injury, distribution, life history, and bionomics of the first have been outlined and remedial measures discussed.

Less is known of the grass grubs, but one species (*Oncopera mitocera* Turn.) has been similarly treated so far as the available information will allow.

Acknowledgments.

It is desired to thank the officers of the Bureau of Sugar Experiment Stations at Meringa for assistance in the identification of white grubs, the Instructors in Agriculture at Atherton for help in transportation, and the various dairying interests on the Tableland, who have always co-operated in the field work incidental to these investigations.

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THE LEAF-EATING LADYBIRD.*

By ROBERT VEITCH, B.Sc., F.E.S., Chief Entomologist.

THE ladybird beetles or Coccinellidæ constitute one of the most important families of insects, largely on account of the fact that the great majority of their species are carnivorous, beneficial insects, feeding, in both their larval and adult stages, on aphids and scale insects. There is, however, one small group of the ladybirds, members of which are phytophagous—i.e., they feed on plant tissue. This group is known as the Epilachninæ, and is represented in Australia by two species that are quite commonly met with, namely, *Epilachna 28-punctata* Fab. and *Epilachna guttato-pustulata* Fab. The former is decidedly the more important of the two, and it is the species that is generally referred as the leaf-eating ladybird.

The leaf-eating ladybird has a wide range of food plants, and in Queensland it commonly attacks potatoes, tomatoes, and pumpkins. Rock-melons and cucumbers are also attacked, and it may frequently be found feeding on nightshade (*Solanum nigrum*), which is also a weed host-plant of another potato pest, namely, the potato tuber moth. The trumpet flower (*Datura stramonium*) is another weed on which this ladybird may commonly be found feeding.

Nature of Injury.

The damage inflicted by this beetle is due to the feeding of both the beetle and the larva of the species, the former feeding freely on the upper and lower surfaces of the leaves, while the latter concentrates its attention on the lower surface. The larva feeds in a very characteristic fashion which is well depicted in the accompanying illustration (Plate 125, fig. 5). It eats a fairly long narrow strip of tissue on the underside of the leaf, but in doing so it does not eat completely through to the upper surface. It then cuts a second strip alongside the first one, the two strips being separated from each other by only a very thin ridge of uneaten tissue. The process is repeated again and again until a comparatively large ragged patch is eaten out of the underside of the leaf, only the thinnest layer of tissue being left intact on the upper surface. The beetles may eat right through the tissue of the leaf.

In recent epidemics this pest has been present in such numbers that the foliage in many cases has been practically destroyed, and even the stems of the attacked plants have been seriously injured. Where extensive injury is inflicted on the foliage there must obviously be a very much reduced yield of the edible product of the plant attacked, i.e., the potato tuber, the tomato fruit, or the pumpkin.

Life Cycle Stages and Life History.

The yellow eggs (Plate 125, fig. 1) are laid in clusters on the foliage, the number laid in each cluster in the field having varied from 13 to 45 during a recent outbreak of this pest. The eggs are typical ladybird eggs, being elongate oval in shape and measuring about $\frac{1}{16}$ inch in length.

* Reprinted from "Pests and Diseases of Queensland Fruits and Vegetables" by Robert Veitch, B.Sc., F.E.S., and J. H. Simmonds, M.Sc. Published by the Department of Agriculture and Stock, Brisbane, 1929.

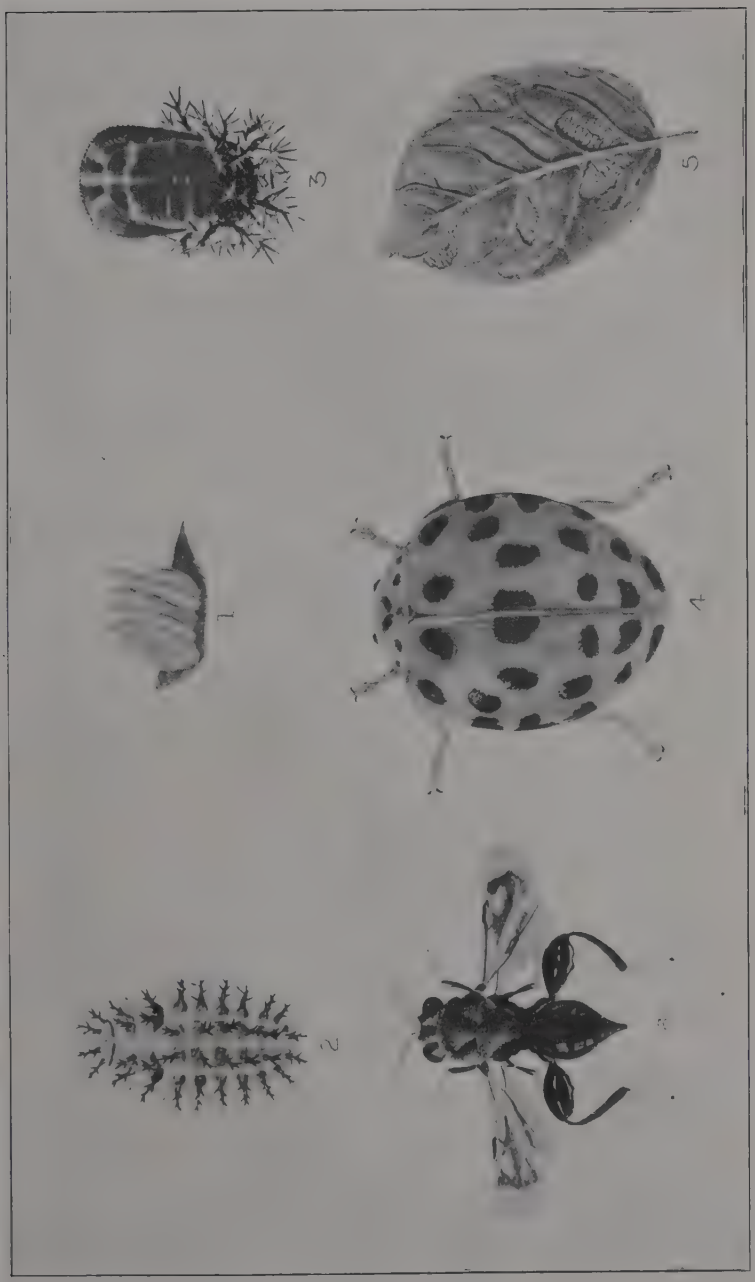


PLATE 125.—THE LEAF-EATING LADYBIRD (*Epilachna 28-punctata* F.)

Fig. 1, Eggs x 5; Fig. 2, Lava x 5; Fig. 3, Pupa x 5; Fig. 4, Adult x 8; Fig. 5, Injury; Fig. 6, Parasite x 8.
(*From a water-colour drawing by I. W. Helmsing*).

The surface of the egg is beautifully reticulated, but such a detail can be observed only with the aid of a lens. The eggs are glued to the foliage at their broader ends. The incubation period during the outbreak already mentioned was four days.

The larva (Plate 125, fig. 2) is a most extraordinary spiny-looking creature, and when full-grown it measures about $\frac{1}{3}$ inch in length. The under surface of the body is yellow in colour, while the upper surface is similarly coloured except for the fact that the yellow colour is broken by rectangular brown areas at the base of the many-branched spines which give the larva its awe-inspiring aspect. The larva possesses three pairs of legs. The larval period lasts for about three weeks, and during that growth period it moults four times.

The pupa (Plate 125, fig. 3) is about $\frac{1}{4}$ inch in length, and may be found securely fixed to the leaf, stalk, or main stem. A conspicuous feature of this pupa is the fact that the last larval skin, moulted when pupation takes place, is attached to the abdominal extremity of the pupa. The pupa itself possesses dark-brown markings broken by creamy-coloured patches. The pupal period during the warmer months in Queensland has been found to extend to only four days.

The oval-shaped beetle (Plate 125, fig. 4) is about $\frac{1}{4}$ inch in length and is yellowish brown in colour. The wing covers bear a number of very conspicuous black spots, whence the name *28-punctata* is derived. The number of these spots is not, however, constant, and they may vary from 12 to 14 on each wing cover. In occasional specimens the yellowish-brown body colour is replaced by a much darker shade which gives the beetle a very dark brown appearance, and in these specimens the black spots do not stand out so conspicuously as in those that are normally coloured. Like other ladybird beetles, this species excretes an unpleasant evil-smelling, yellowish fluid when it is handled. Recent life-history investigations by Miss Temperley showed that in the laboratory the female beetle may lay as many as 252 eggs.

Control Measures.

Outbreaks of this pest are fortunately not long-lived, but while they last they may be very severe. Experience has shown, however, that it yields readily to treatment with arsenical sprays. Whenever it is noticed becoming abundant on the foliage of any of its host plants of economic importance, steps should be taken to spray the same with arsenate of lead. Dusting may be adopted as an alternative to spraying.

Natural Enemies.

A hymenopterous parasite, *Stomatoceras colliscutellum* Gir. (Plate 125, fig. 6), occurs in the pupæ of this pest, and it may be of some little service in limiting the abundance of the insect, but it is not thought to be at all effective as a control factor. Miss Temperley, in the course of recent life-history studies of this pest, was led to suspect that the very widely distributed and much maligned little ant, *Pheidole megacephala* Fab., was responsible for the destruction of many of the eggs of the leaf-eating ladybird. Certainly in several countries to which this small ant has been introduced it has exercised a high degree of influence on the native insect fauna, and it may be that in Queensland it is including the leaf-eating ladybird in the list of insects suffering from its presence.

EXPERIMENTS WITH A NEW FRUIT FLY LURE.

By HUBERT JARVIS, Entomological Branch.

THE trapping of fruit flies (Trypetidæ) by means of attractive odours or lures, was first practised in Queensland about 1914, but it had long been realised by entomologists in other countries that certain species of fruit flies reacted to specific odours.

In 1909, W. W. Froggatt recorded the attraction to citronella oil of the male only of the mango fruit fly (*Dacus ferrugineus* F.) and mentioned that when in India he was able to take hundreds of the flies with one sweep of a fly net over foliage on which the oil had been sprinkled. C. W. Mally, in South Africa, also found in 1909 that paraffin oil attracted the Mediterranean fruit fly (*Ceratitis capitata* Wied.). Following on C. W. Mally's work C. P. Lounsbury recorded the fact that both sexes of the Mediterranean fruit fly were attracted to paraffin oil, the males greatly predominating. F. M. Howlett, in India in 1912, discovered that the males of the peach fruit fly (*Dacus zonatus* Saund.) were strongly attracted to citronella oil, and E. A. Back and C. E. Pemberton, in 1914, demonstrated in Hawaii that many oils derived from crude petroleum, and also certain vegetable oils, attracted the males of the melon fruit fly (*Dacus cucurbita* Coq.) and the Mediterranean fruit fly (*Ceratitis capitata* Wied.). Later L. J. Newman, in 1923, was successful in trapping large numbers of fruit flies in Western Australia with a pollard and water bait. The species concerned in this case was the Mediterranean fruit fly, both sexes being attracted.

In 1914, Mr. A. W. Harvey, of Queensland, evolved a lure with which he was successful in trapping the males of the Solanum fruit fly (*Chætodacus dorsalis* Hendel), an innocuous species, and after further experiment he produced a lure which attracted the male of the Queensland fruit fly (*Chætodacus tryoni* Frogg.) and later the female also of this species. The Harvey lure has been successfully used in Queensland orchards.

Stanthorpe Experiments.

During the last five years tests of the olfactory reaction of fruit flies to various oils and vegetable essences have been made with varying success by the writer, and it was found that the Queensland fruit fly, which is the most destructive species in this State, was indifferent to any of the odours that were so attractive to other fruit flies elsewhere.

In 1928 the writer formulated a lure which was successful in attracting both sexes of the following species of fruit flies:—(1) The Queensland fruit fly (*Chætodacus tryoni* Frogg.); (2) the Jarvis fruit fly (*Chætodacus jarvisi* Tryon); (3) the small black fruit fly (*Dacus niger* Tryon); (4) the Solanum fruit fly (*Chætodacus dorsalis* Hendel); (5) the boatman fruit fly (*Rioxa musæ* Frogg.); and (6) the Mediterranean fruit fly (*Ceratitis capitata* Wied.).

The lure, which is a combination of imitation vanilla essence, ammonia, and water, was found to be particularly attractive to the Queensland fruit fly, and to the Mediterranean fruit fly, the latter in New South Wales, where it was tried out during the season 1928-29 by Mr. F. Chilton, of Sydney. During the season 1929-30 this lure was used with much success by many orchardists in the Stanthorpe district, and also in the Toowoomba district.

As the lure was considerably cheaper than any then on the market, and was easy of manufacture by the orchardists themselves, and as,

moreover, the general concensus of opinion indicated that luring was considered a control measure of definite value, it was decided to test the new lure in comparison with the only other lure on the market, this having been hitherto practically exclusively used, and the results obtained during the 1929-30 and 1930-31 seasons are tabulated in this report.

Details of Experiments.

Two orchards situated one at the northern and the other at the southern end of the Stanthorpe district about 12 miles apart were chosen for the work.

In Orchard No. 1 sixty traps were used in both seasons, and in Orchard No. 2 thirty-eight traps were used in the 1929-30 season and forty-eight in the 1930-31 season. An equal number of traps was used in each orchard for the respective lures. The area under fruit trees was in each case about 20 acres, comprising pomaceous and stone fruits of both early and late-maturing varieties.

The traps used to contain the lures were the ordinary commercial glass-bowl fly traps, retailed at about 1s. 9d. each. They were hung in the trees by means of strong wire twisted around the neck of the trap and bent into a convenient hook at the end. The lure was renewed as required. In normal summer weather weekly rebaiting was generally found to be sufficient, but exceptionally drying conditions or the upsetting of traps by high winds often necessitated a more frequent renewal of the lure. Furthermore, the lure in traps set in trees of a fairly open growth evaporated more quickly than in those traps that were placed in the more shady trees. The traps containing the respective lures were suitably marked to avoid confusion, and they were replicated each week—i.e., the traps containing one lure being placed in the situation occupied by the traps containing the other lure, and vice versa. This was done because it has been repeatedly observed that certain situations in an orchard are always more favourable for fruit fly congregation, owing to shelter from wind, or the presence of large, leafy trees in such situations which are always more attractive to fruit flies than are trees of a smaller and more open growth. Thus, by weekly change of the position of the traps containing the different lures, each was given as equal a chance as possible.

The flies were removed from the traps and counted by the orchardists concerned, the catch from each lure being placed in marked bottles. A check count was then made, and the sexes represented in each case were separated and the females examined for egg development. No count was made of flies other than fruit flies nor of the number of eggs contained in individual female flies. The amount of liquid used in each trap at a setting was approximately 6 oz.

It was found that both lures would keep at the solution mentioned unimpaired for twelve months.

The Harvey lure was supplied direct from the maker, in 1-gallon tins, and was used as directed, at a strength of 1-5.

The cost figures given in Table 3 are based in the case of Harvey lure on the Brisbane wholesale price charged by the maker for this lure, and in the Jarvis lure on the wholesale prices of household ammonia and imitation vanilla essence.

Formula of Jarvis Lure.

The formula used in the Jarvis lure throughout the experiments was imitation vanilla essence $\frac{1}{8}$ oz., household ammonia $\frac{1}{2}$ oz., water

26 oz. This was supplied to the orchardists in 26-oz. bottles, at a five to one strength. They were also given the formula to enable them to make the lure if necessary.

Seasonal Infestation of Fruit Fly.

During the season 1929-30 there was a comparative freedom from fruit fly attack throughout the district; in fact, in this respect it was the most notable season for eight years. The figures in Table 1 show the relatively small number of fruit flies trapped in the experimental orchards during the period mentioned. The very gradual increase of fruit fly during the season, reaching its maximum in February, would appear to indicate that the quota of flies in 1929-30 originated from local increase rather than from the immigration of fruit flies from outside areas.

In the season 1930-31, however, the appearance of fruit flies in the Stanthorpe district in large numbers during November occasioned a serious view of the position, there being a notable numerical increase of fruit fly and consequent damage to fruit in comparison with the four previous seasons. It was concluded that immigration was the main factor occasioning this outbreak of fly, as the majority of flies examined from the traps showed signs of age and travel, the wings in many instances being much chipped and worn, the colour of the flies dark, and the females contained ripe eggs in the ovaries. But in spite of the rather serious damage caused by fly to early stone fruit all through the district during November, 1930, the position steadily improved, the inconsiderable damage from this source during the remainder of the season being the most remarkable for many years. Late apples left on the trees during March and April remained free from fruit fly attack.

Seasonal Weather Conditions.

Weather conditions throughout the period embraced by the experiments were more than usually dry and hot, thus being unfavourable for fruit fly propagation. This was particularly so in season 1930-31, when the total rainfall from 1st November to the end of March was the lowest for many years, being only 1,012 points, and it cannot but be concluded that the dry conditions experienced operated to advantage by destroying countless numbers of fruit fly puparia in the soil.

Summary.

It will be realised that the period covered by the work undertaken was not ideal for obtaining conclusive results as to the importance or otherwise of luring as a control measure for fruit fly.

It has yet to be ascertained just how important luring is in a bad season when the fly is epidemic, but the trapping of large numbers of fruit flies, of which the majority are females, must in no small degree help in limiting local fruit fly increase, especially when it is realised that each female fly is capable of depositing about sixty or seventy eggs.

From the information set out in the accompanying tables it can at least be concluded that Jarvis lure is equally as attractive to both sexes of the Queensland fruit fly as any other lure on the market.

Most of the Stanthorpe orchardists, including the owners of the experimental orchards, now agree that this lure is in every way equally as efficient as any lure on the market. Being cheap, efficient, and easy of manufacture, it should meet the requirements of those interested in luring as one of the means of combating the fruit fly pest.

TABLE I.

Details of Fruit Fly Luring Experiments.

(The Counts in all Tables relate to the Queensland Fruit Fly, *Chaetodacus tryoni* Frogg.)

Months.	Total Number of Flies Caught.			Number of Male Flies Caught.			Number of Female Flies Caught.			Number of Female Flies with Eggs Caught.		
	Jarvis Lure.	Harvey Lure.	Total.	Jarvis Lure.	Harvey Lure.	Total.	Jarvis Lure.	Harvey Lure.	Total.	Jarvis Lure.	Harvey Lure.	Total.
Orchard No. 1 (1929–1930).												
1929.												
November	17	8	25	4	3	7	13	5	18	10	3	13
December	40	24	64	13	11	24	27	13	40	20	6	26
1930.												
January	33	21	54	7	9	16	26	12	38	26	4	30
February	42	31	73	12	8	20	30	23	53	14	4	18
March	39	14	53	2	6	8	37	8	45	31	7	38
Totals	171	98	269	38	37	75	133	61	194	101	24	125
Orchard No. 2 (1929–1930).												
1929.												
October	8	18	26	2	0	2	6	18	24	4	1	5
November	17	30	47	2	1	3	15	29	44	0	0	0
December	7	6	13	0	0	0	7	6	13	4	4	8
1930.												
January	33	29	62	3	11	14	30	18	48	12	4	16
February	202	222	424	7	23	30	195	199	394	124	156	280
March	20	16	36	7	5	12	13	11	24	10	8	18
Totals	287	321	608	21	40	61	266	281	547	154	173	327

TABLE I.—*continued.*

DETAILS OF FRUIT FLY LURING EXPERIMENTS—*continued.*

(The Counts in all Tables relate to the Queensland Fruit Fly, *Chaetodacus tryoni* Frogg.)—*continued.*

Month.	TOTAL NUMBER OF FLIES CAUGHT.			NUMBER OF MALE FLIES CAUGHT.			NUMBER OF FEMALE FLIES CAUGHT.			NUMBER OF FEMALE FLIES WITH EGGS CAUGHT.		
	Jarvis Lure.	Harvey Lure.	Total.	Jarvis Lure.	Harvey Lure.	Total.	Jarvis Lure.	Harvey Lure.	Total.	Jarvis Lure.	Harvey Lure.	Total.
ORCHARD No. 1 (1930–1931).												
1930.												
October	13	11	24	2	2	4	11	9	20	9	9	18
November	96	76	172	10	19	29	86	57	143	75	41	116
December	88	30	118	18	8	26	70	22	92	66	20	86
1931.												
January	107	61	168	38	31	69	69	30	99	67	23	90
February	18	3	21	4	2	6	14	1	15	14	1	15
March	11	2	13	2	2	4	9	0	9	6	0	6
Totals	333	183	516	74	64	138	259	119	378	237	94	331
ORCHARD No. 2 (1930–1931).												
1930.												
November	121	120	241	36	44	80	85	76	161	78	72	150
December	187	155	342	26	24	50	161	131	292	155	125	280
1931.												
January	80	56	136	38	35	73	42	21	63	26	16	42
February	13	20	33	3	11	14	10	9	19	8	8	16
March	14	29	43	3	9	12	11	20	31	11	20	31
April	3	3	6	1	0	1	2	3	5	2	3	5
Totals	418	383	801	107	123	230	311	260	571	280	244	524

TABLE II.

SUMMARY SHOWING TOTAL CATCH OF FLIES AND PERCENTAGES CAUGHT IN THE RESPECTIVE LURES.

	Males.						Females.						Females with Eggs.					
Total Numbers of Flies Caught.	Jarvis Lure.	Per Cent. of Total Flies Caught.	Harvey Lure.	Per Cent. of Total Flies Caught.	Total Males.	Per Cent. of Total Flies Caught.	Jarvis Lure.	Per Cent. of Total Flies Caught.	Harvey Lure.	Per Cent. of Total Flies Caught.	Total Females.	Per Cent. of Total Flies Caught.	Jarvis Lure.	Per Cent. of Total Females.	Harvey Lure.	Per Cent. of Total Females.	Total Females with Eggs.	Per Cent. of Total Females.
							Orchard No. 1 (1929–1930).											
269	38	14·1	37	13·7	75	27·8	133	49·5	61	22·7	194	72·2	101	52·0	24	12·4	125	64·4
							Orchard No. 2 (1929–1930).											
608	21	3·4	40	6·6	61	10·0	266	43·8	281	46·2	547	90·0	154	28·2	173	31·6	327	59·8
							Orchard No. 1 (1930–1931).											
516	74	14·3	64	12·4	138	26·7	259	50·2	119	23·1	378	73·3	237	62·7	94	24·9	331	87·6
							Orchard No. 2 (1930–1931).											
801	107	13·4	123	15·3	230	28·7	311	38·8	260	32·5	571	71·3	280	49·0	244	42·7	524	91·7
							Grand Totals.											
2,194	240	11·0	264	12·0	504	23·0	969	44·2	721	32·8	1,690	77·0	772	45·7	535	31·6	1,307	77·3

TABLE III.

DETAILS OF QUANTITIES AND COST OF LURES.

Season.	Orchard.	Lure Used.	Number of Gallons Used.	Cost per Gallon.	Cost per Orchard for each Lure.	Total Cost of each Lure.
				s. d.	£ s. d.	£ s. d.
1929–30	No. 1	Jarvis	6	2 9	1 7 6	2 8 1½
1930–31	No. 1	Jarvis	4			
1929–30	No. 2	Jarvis	4	2 9	1 0 7½	
1930–31	No. 2	Jarvis	3½			
1929–30	No. 1	Harvey	6	10 0	5 0 0	8 15 0
1930–31	No. 1	Harvey	4			
1929–30	No. 2	Harvey	4	10 0	3 15 0	
1930–31	No. 2	Harvey	3½			

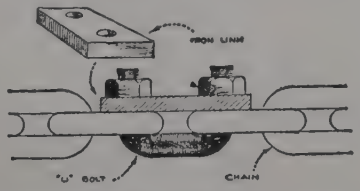
TABLE IV.

MONTHLY RAINFALL READING DURING THE PERIODS OF THE EXPERIMENTS.

1929–30 Season.			1930–31 Season.		
Month.	Number of Days on which Rain Fell.	Total Rainfall.	Month.	Number of Days on which Rain Fell.	Total Rainfall.
1929.		Points.	1930.		Points.
November	8	265	November	9	149
December	9	336	December	7	179
1930.			1931.		
January	14	208	January	6	165
February	10	136	February	7	332
March	11	230	March	13	187
April	11	387			
Totals	63	1,562	Totals	42	1,012

CHAIN REPAIR.

According to the old saying, a chain is no stronger than its weakest link, and it sometimes happens that we find that particular link when we try to lift a load that is too heavy for the wagon lift at the elevator, or when we try to move a stone that is too heavy with the log chain hitched to the tractor. Chain is used in many ways on the farm, and when broken they can be repaired in a very satisfactory manner with the repair link illustrated here.



This repair link consists of two parts—a "U"-shaped bolt and a short piece of heavy strap iron. The "U"-shaped bolt is made of a piece of iron rod threaded on both ends. The threads must be cut before the rod is bent. The strap iron link has holes drilled in it at near each end. These holes are spaced the same as the spread of the bolt. The ends of the chain are united by the link as indicated. The diameter of the rod used in making the "U" bolt should be the same as the diameter of the material used in making links so that it will be of equal strength. The nuts are drawn down tight and the threads battered to keep them from working off.

CITRUS CULTURE.

By GEORGE WILLIAMS, Director of Fruit Culture, and R. L. PREST, Instructor in Fruit Culture.

THOUGH suitability of soil is one of the main considerations to be exercised when contemplating the establishment of a citrus orchard, markets and transport are of equal importance. In respect of markets the local season of crop maturity must be allowed for, and preference given to early, late, or midseason varieties as the demand warrants. In the most suitable coast lands growth is more vigorous than in inland districts, but, aided by irrigation in those where low rainfall is experienced, a firmer fruit of better appearance, texture, and quality is produced. Very much depends on a regular and moderate supply of moisture to develop the full flavour of the fruit, which is not attainable under an excess or fluctuating quantity. Before we can anticipate an appreciable export trade in oranges, production in districts beyond the range of influence of coastal atmosphere must be effected.

The soil conditions essential to satisfactory development of the trees, their cropping and longevity, are, briefly, good natural drainage, fertility, and friability. The land features should be as nearly level as possible, particularly where irrigation is to be applied. Drainage is indispensable —in its absence no other soil treatment can counteract the deficiency. Admitted that it can to some extent be provided adventitiously, but this cannot economically apply throughout an orchard, and will at the best not equal results where this essential is provided by nature. Fertility cannot be overlooked, though the physical condition of the soil may admit of deficiency within certain limits being remedied by judicious fertilizing. The maintenance of fertility is more readily effected in soils originally possessing the essential elements of plant foods. Land with very defined slopes is subject to erosion to a serious extent, particularly in districts experiencing very heavy rains. Provision may be made for the diversion of storm waters by furrows across slopes, but they are at the best unsatisfactory. There is ample land to select from, and that which requires a minimum of labour should receive preference.

In forest land the clearing of original timber, including stumps and roots to a depth of at least 12 inches, should be thorough—15 to 18 inches would be preferable so that subsoiling might be satisfactorily conducted throughout. It is much preferable to defer planting for a season than to attempt it where the land is unprepared. A light ploughing should follow upon clearing, leaving the ground in the rough to destroy such vegetation as may be included. Cross ploughing, cultivating, and harrowing for further reducing the soil to a fine tilth and collecting coarse weed growths and small roots are necessary. In most cases it is not desirable to bring the soil from a depth exceeding 10 inches to the surface, and where subsoiling is practised (though the deeper this is effected the better) the subsoil is merely disturbed or broken without any change in its position. The advantages of subsoiling are briefly that the effect of loosening the soil renders it more permeable to the roots, and the capacity for the retention of moisture during dry spells is much increased. Surface roots are undesirable, particularly in districts subject to a wide range of temperature. Where land clearing, including "running" roots, has not been effected to a sufficient depth to admit of the use of a subsoiling implement, explosives may be used, but trenching a field by this means at present rates will be found rather costly.

For explosives to be effective, the soil should be in a dry condition, and gelignite plugs (not less than ¾-inch diameter) inserted in the bottoms of holes of small diameter and of a depth of not less than 2 feet 6 inches to 3 feet would be preferable. Filling the hole, after inserting the charge, with dry sand will be all the tamping necessary. The lateral effect of the explosion is approximately 7 to 8 feet. The lighter the soil the less is the resistance and consequent reduction of shock.

Do not consider planting in forest lands until the necessary cultural operations have been completely and satisfactorily performed. Upon preliminary work much will in the future depend; consequently the occasion to be thorough cannot be too emphatically emphasised.

For laying out the orchard site a supply of short stakes is one of the first requirements. The distance apart and system of planting will determine the number for a given area. Planting is usually on the square system, and this is favoured in preference to what is generally known as the septuple (where each tree, excepting outer rows, is equidistant from its four nearest neighbours), practically planting in squares with a tree in the centre of each square. The septuple method admits of a larger number of trees per acre, but cannot be as economically worked nor offer equal facilities for interculture as square (or rectangular) planting.

For a 6-acre orchard an ordinary 66-feet tape will answer for laying out, but with larger areas, in addition to the tape, a marking wire is recommended. Ten-gauge galvanised steel is adapted for the purpose, having pieces of copper wire wound around it at the required distances apart, and soldered on to prevent their shifting; about ½-inch width is sufficient to readily detect the spots. A 3-inch ring of ½-inch round iron is securely fastened at each end, one of which is used as the distant end 3 or 4 feet beyond the last spot, the other at the exact space distance from the first spot on the wire. It is advisable to fasten these rings before attaching the copper spots. On the alignment being determined for one side this should be pegged at the required distances, and a rectangular line taken from each end to the corresponding corner of the opposite side, when this can be similarly pegged, utilising two crowbars, one being placed firmly in the position the one side peg previously occupied and one of the iron rings slipped over the top well down to the base. The wire is then unrolled across the field, and the other bar used (in the correct alignment) to pull the wire taut, and is driven into the ground to retain it so until the pegs are inserted—one at each spot. Practice demonstrates the advantage of leaving the ring at the straining end of the wire some distance beyond the correct place for the pegs which will be indicated by the copper wire spot. On ground of even feature 350 feet of wire can, by an overarm swing applied simultaneously at both ends, be readily moved from the site of one row to that of the next, and where the pegs are available three smart men will lay out 10 acres in one day.

The use of the planting board in ensuring the young tree being placed exactly in the site occupied by the peg has been frequently described in Departmental publications. For the reception of the trees, the surface soil should be taken out and placed on one side. Where explosives have not been used the subsoil should be broken up finely with a digging fork. There is no advantage in having the holes opened out in advance of the planting more than is necessary, as it only results in loss of moisture for no benefit. In planting, it is desirable that when

PLATE 126.—1. LISBON LEMON. 2. SICILIAN LEMON.

the soil has settled down the stock be not deeper than it had originally been grown in the nursery. It is preferable to err on the side of high planting. This is more material in the case of worked than seedling trees. In worked trees the junction of stock and scion should invariably be above the level of the surrounding soil surface. The roots should be spaced as evenly as possible and with a downward slope of 40 to 45 degrees, the spaces being filled with fine soil and pressed firmly, water being applied before the hole is completely refilled and allowed to soak into the soil before the refilling is completed.

The season of planting will be determined by location and local circumstances. Where low temperatures are experienced, July or early August planting is preferable to autumn, but where there is no danger of frost injury, autumn planting is satisfactory. It enables the trees to obtain a roothold, thereby materially assisting the early spring growth. In the warmer districts growth frequently continues right through the winter. Provided the young trees were sufficiently hardened in growth before being taken from the ground in the nursery (in the anxiety to get an early start planters are apt to urge nurserymen to forward before the requisite stage has been reached in autumn), and efficiently packed, they carry satisfactorily. As the methods of packing vary according to the time occupied in transit, it is often advisable to intimate when ordering the approximate time the package would be on the road. If the trees are lifted too early this will later be evidenced in the decay of the fibrous roots, a feature which will also be present if an excess of moisture is present in the packing material. Where the roots have been exposed to the drying influence of atmosphere, either in the nursery or after receipt, a similar result will ensue. Where the fibres are destroyed as a result of exposure, growth will be slow in starting, and the extremes of branches frequently die back. When attributable to excess of moisture or soft wood, the buds will frequently start in all parts, but those on the upper parts make but little headway, and become stunted or die back, and fresh growth originates near the base. Though the roots should be packed tightly and firmly for transport, the tops should not be tied tightly, and will better retain their condition if dry straw is interspersed amongst them. For autumn planting it is not advisable to defoliate the trees, but those which have been subjected to the hardening influence of cold weather will carry more satisfactorily if the whole of the foliage is removed. This, however, is not the general practice, and planters will find a more even start if they entirely defoliate spring-planted trees, and, at the same time, effect the necessary pruning or thinning of branches to ensure development on lines required. The most important item for attention in handling trees for planting is not to allow the roots to become dry under any circumstances, nor, to go to the other extreme, to allow them to remain immersed in water for more than two hours at any one time. When a large bundle is unpacked have trenches ready in which to place the plants close together, filling in the spaces with fine soil, and immediately water. For planting, take out a limited quantity at a time, and either keep their roots in water or rolled in damp straw in a wet bag, taking them out one at a time as planted.

Varieties.

Some twenty-two varieties of oranges, fifteen mandarins, six lemons, and an equal number of grape fruit are catalogued. An unwise selection frequently covering a wide range of varieties is mainly responsible for

PLATE 127.—LISBON LEMON TREES.

the number of unprofitable trees existing in the majority of orchards. The market requirements are reasonably met with a limited range, and this can be confined to trees of vigorous constitution and habit. There is nothing whatever to be gained, but much to be lost, by a wide assortment. The influences of different districts so affect some varieties that, whilst they may be very satisfactory in some, they are quite unsuited to others. Standard packs are being adopted for marketing citrus, and profitable marketing cannot well be conducted otherwise. To maintain such standards the least number of best varieties maturing over the season are indispensable; wide assortments merely defeat the object.

In oranges, Washington Navel, Joppa, Byfield Seedless, and Late Valencia are recommended. Some confliction exists between Jaffa (which is suitable only to specific districts and not characterised by high sugar content) and Joppa. The latter can be recommended for any part of the State. It is of good constitution, comparatively free from thorns, and a heavy and consistent bearer. Seeds are few, averaging about eight. Byfield Seedless has not been much in demand, although suitable to all citrus districts. The tree is very robust and thorny, and a good cropper. The texture and flavour of the fruit are good, and the entire absence of seeds is a special recommendation. Crops will hang until very late in the season, and the name "Seedless Valencia" has in places been applied to it on this account. Late Valencia is of wide distribution, and invariably satisfactory. An exceptionally vigorous sport, with rather larger fruit, which matures some weeks later than those of the parent; originated at Redlands. A very limited number of trees has been distributed, but larger quantities are now available and can be recommended. It is worthy of note that two of our best oranges, the Valencia sport and Byfield Seedless, originated in the State, and the highest quality mandarin, Beauty of Glen Retreat, is also of local origin. Other very promising mandarins have been brought under notice from Howard, Beaudesert, and Maroondan, but before these can receive endorsement for general planting it is desirable that they be tried in districts other than those of origin. The range of mandarins recommended has been limited to Beauty of Glen Retreat, Emperor, and Scarlet, with the addition of King of Siam in the northern parts of the State. Until something which is an improvement upon any of these—not only in respect of any special feature, but also in productivity and all-round market requirements—has been proved, it is not considered advisable to extend the list. Unfortunately, due care has not invariably been exercised in the selection of budwood for propagation, which is to some extent responsible for the presence of unproductive trees of standard varieties in very many citrus orchards. The principal nurseries have taken this matter up seriously, and much more reliable trees are now obtainable. To entirely eliminate this undesirable feature a citrus plot has been established by the Department in the Gayndah district, from which it is expected that sufficient budwood will be available as the trees (which have been propagated from selected wood taken from the best trees in the State) develop to meet the requirements of our propagators. In addition to oranges and mandarins, lemons and grape fruit have been included. Regarding the latter, more discrimination is being exercised in determining the genuine article. Several varieties have been introduced, and up to the present Marsh has been favoured, but is likely to be superseded by Duncan when the latter becomes better known. Other varieties are hardly worth considering. Regarding lemons, the

PLATE 128.—CLUSTER OF VALENCIA LATE ORANGES.

prospect of increased demand is not attractive. Lisbon, Genoa, and Villa Franca are unlikely to be superseded. Lemon culture on coastal lands is not recommended. The life of the tree is comparatively short, and the quality of the fruit at the best moderate and becoming inferior and gummy prior to the complete decay of the tree. The Tahiti Lime, which is sometimes referred to as a seedless lemon, is better adapted to coastal conditions and fulfils the requirements of the lemon, excepting in respect of the peel, which is valueless.

Other varieties of citrus which are grown to a limited extent and suitable for preserves are the citron, cumquat, poor man's and sour orange, pomelows, and sevilles. The latter are in limited demand for the manufacture of marmalade. Cumquats may be similarly used, but are preferable when preserved in syrup. Beyond small supplies for home use, there is no demand. Citrons are seldom successful and, being very subject to disease, can hardly be considered from a commercial aspect. Pomelows (or shaddocks) are not worth planting.

Stocks.

In nursery practice choice is confined to two kinds—seedling sweet orange and the Bergamot or common lemon. For mandarins, seedlings of the Scarlet type may well be considered. In deep soils, particularly basaltic and those of light texture, orange trees worked on to the sweet orange have given the best results. For heavier soils the lemon root will give at least equal return. One of the principal advantages of the orange stock is that the trees have much greater longevity—the growth in early years is slower but more lasting, and trees usually attain much larger dimensions. Trees on lemon are more vigorous in the first place, and will give a heavier return in the first few productive years. The common lemon is in general use as stock for grape fruit and lemons.

Selection.

In selection consideration must be given to market requirements, though it is usually advantageous to have the period of harvesting extended. Where early marketing is the most profitable, attention should be mainly confined to an early variety, and allowance made for assistance in harvesting. With mandarins consideration must be given to local influences. Some localities, particularly Howard and Byfield, are specially adapted for producing the Emperor, whilst Gayndah excels in Glen Retreat. Where any doubt exists in respect of suitability of varieties or other features, the intending planter should make inquiries from the Departmental district officer.

That preference be given by intending planters to trees grown in Queensland cannot be too strongly emphasised. Our nurseries are registered with the Department and their stocks are carefully inspected at regular intervals. Grade standards, which provide for normal development, are also applied to trees grown for sale. Unfortunately, serious disease not apparent at the time of planting has been introduced with trees from nurseries over which we have no control, and has created a very serious situation throughout the district in which they were planted.

Planting Distances.

Twenty to 25 feet apart, according to location, covers the average span allowed for development (where seedling trees are planted 25 feet should be allowed), 24 feet being considered a fair average. This allows

seventy-five trees per acre where planted on the square system. With mandarins 20 to 22 feet may be sufficient, but in small areas it is advisable for economic working that an equal distance be allowed throughout. Where the area exceeds 6 acres, separate blocks for oranges and mandarins would be allowed.

Training the Young Trees.

Pruning where necessary should be effected immediately prior to or soon after planting. In mandarins there is frequently an excess of branches. These should be removed to the extent that not more than four, to make the future main branches, remain. These should be spaced as evenly as possible, and if not robust, shortened by a-third or two-thirds of their length. Where the number of suitable branches for forming the tree are not present or are unfavourably placed, those which are misplaced should be entirely removed and others materially shortened to induce fresh growth. The removal of surplus shoots in their early stages should be followed in subsequent growths to prevent overcrowding, to direct the energies of the plant into permanent channels, and to avoid future amputations. As the young trees progress the occasion for frequent attention diminishes, but it is advisable at every cessation of growth to go over the trees and relieve any crowding or further development of branches which would ultimately result in that feature. Mandarins, particularly the Beauty of Glen Retreat, are prone to produce far more branches than desirable, and where these are allowed to remain a crowded tree of weak constitution and carrying dead wood in the centre will result. Remedying at later stages entails the amputation of large branches, which is undesirable.

Where any branch shows an excess of vigour and tendency to outgrow the remainder it should be stopped whilst in an early stage by pinching out the terminal. This is more effective than allowing it to continue until general pruning and then shortening. Where branches have a drooping habit they should be relieved of a part of their weight by shortening and the cut made to a bud pointing upwards. This feature is rather prevalent in navels and present to a less extent in Valencias.

General Pruning.

Provided the young trees have been reasonably tended subsequent pruning is simple and confined mainly to the removal of surplus small branches and shortening in older trees to induce new fruiting wood to supplant such as may have become crowded or weakened through overproduction. Free admission of light and air are essential to the maintenance of healthy growth. See that due provision is made for this at the annual pruning, which, in bearing trees, is done immediately following the removal of the crop.

In removing young shoots the practice of breaking or rubbing them off may be expeditious, but is generally unsatisfactory, particularly on stems of young trees or at later stages on heavy branches. The shoot is temporarily removed, but generally adventitious buds followed by several shoots develop around its original base, and the effect of continuing to rub these off originates a callus, which must eventually be cut away. A clean knife cut in the first instance would have been followed by rapid healing and no further trouble.

PLATE 129.—EMPEROR MANDARINS.

In pruning, all cuts should be clean and not left with jagged edges, and where the removal of a branch is necessary it should be effected by a cut as nearly corresponding with the direction of that from which it was removed and as closely to it as possible; no shoulders, snags, or projections of any kind should show on a pruned tree. In shortening branches, cuts should commence about the level or slightly below (dependent on the diameter of the branch) and opposite the bud which it is intended to develop and emerge slightly above it. A cut surface reasonably close to the bud will heal rapidly, and this also applies to branches cut close to the stem. It may not always be possible to remove surplus branches with the pruning saw, and a chisel and mallet should then be brought into requisition. In addition to these, a heavy "Saynor" pruning knife and secateur are requisite. All tools should be kept in the best possible condition—neat work is not performed with dull tools—and invariably oiled after use. The practice of painting wounds has many advocates, but its benefits are problematical. Saw cuts of any size should be smoothed, particularly around the edges, with a sharp chisel or knife. Lengthy experience and fairly extended observation have not noted a single instance of decay of wood or any damage whatever where cuts were correctly made and finished, in amputations up to several inches in diameter. After pruning or cutting trees affected with fungoid disease, tools should be dipped in formalin or carbolic acid to prevent subsequently infecting other trees upon which they may be used.

Pruning Lemons.

Lemons require slightly different training, and should from early stages be pruned to develop a fairly hollow centre and fewer large lateral branches. The finest fruit is produced on short spurs, from larger branches, and the formation of these is to be encouraged. The tree is often inclined to be more vigorous than productive, and this is rectified by topping the long branches about midsummer. Small branches may also be converted into fruiting spurs by cutting them back to within about 6 inches of their base during a growing period. The growth of the Tahiti lime being more of a drooping habit, thinning of branches is the principal attention required, and as development proceeds the removal of some of the lower branches is often desirable.

Fertilizing.

In reasonably fertile lands, the addition of fertilizer to the soil before or at the time of planting is unnecessary, but in land which has been previously cropped or that which would not be classed as fertile, assistance in this direction to the growing plants is required. Whatever fertilizer is applied, it should be incorporated with the soil, so that young roots in traversing the soil may come into contact with it but not brought into contact with existing roots at planting.

As the trees develop, the quantity of fertilizer required for each will correspondingly increase, and when fully developed an evenly continued regular supply is necessary. As crops are produced, so the natural fertility of the soil is being depleted, and where it has not been maintained by the application of such fertilizer as available, the effect is shown in impaired vigour of the tree and in the quantity and quality of its product. Where the lack of vigour mainly attributable to this cause is very pronounced (it may arise from other causes than absence of fertility or in combination therewith) drastic pruning is often

PLATE 130.—A WELL-GROWN GLEN RETREAT MANDARIN.

necessary, even to the extent of heading back the main branches to within a few feet of their bases, to induce growth and practically to form a new head. A liberal application of fertilizer prior to the spring growth is also recommended. In volcanic soils, for a first dressing, an application of agricultural lime at the rate of 2 tons, Nauru phosphate at the rate of 10 cwt., sulphate ammonia 3 cwt., sulphate potash at 2 cwt. per acre has been found satisfactory, with subsequent half-yearly applications during July and midsummer. The maintenance of a supply of humus in the soil is absolutely indispensable.

The application of fertilizers twice a year is generally profitable, and improves both quality and quantity of the fruit. A mixed fertilizer, containing 2 lb. to 3 lb. sulphate of ammonia, 2 lb. to 6 lb. Nauru phosphate and superphosphate mixture (half of each), 1 lb. to 2 lb. sulphate of potash, applied at the rate of 4 to 16 lb. per tree, in accordance with its age, is recommended.

Interculture.

Ordinarily in Southern and Central Queensland, a citrus orchard is four to five years after planting before a return can be expected, consequently interculture is practised so that some return may be realised whilst the trees are developing. This, in some instances, is conducted to the extent of affecting their development, and has been particularly noted where pineapples are included. Pineapples, tomatoes, strawberries, and dwarf-growing vegetables (other than sweet potatoes), peanuts, &c., may be satisfactorily grown as inter-crops, but they should not be planted sufficiently close to the tree to impede its growth by encroaching upon its supplies of moisture and plant food; the actual distance will depend upon the variety grown, and to allow for the development of the trees the space allotted must be annually extended. Tall-growing crops should on no account be included in young orchards, and the extent of the ramification of the roots of those included must be considered.

Orchard cultivation in some phases has been a contentious subject, some growers averring that the introduction of the plough was detrimental, others consider it indispensable. The latter opinion is favoured and its adoption from the inception advised, though in average soils, for general working, the disc cultivator is considered more satisfactory. The effect of ploughing amongst trees, which had been permitted to develop without such attention, is that by severing the roots (which should not have been allowed to develop) trees are checked and growth and production suspended, and this can only be rectified within reasonable time by severely heading back their branches. The use of the plough or disc cultivator from early stages will not only prevent the development of surface roots but allow of a desirable mulch of loose soil being made available as required during the drier months of the year. The extent to which this can be availed of depends on local conditions, including the nature of the land and, if not practically level, the grade of fall. Sandy soils are more liable to "wash" than those of a loamy nature, but in either, where the fall is appreciable, heavy losses of surface soil is likely to occur in a very short time, consequently the provision of a loose mulch at the time of the year when heavy rainfall would be expected is considered inadvisable. It would be preferable, where soil wash was liable, to maintain a cover growth which later could be ploughed under to maintain the supply of humus. In all cases consideration of

PLATE 131.—A GOOD TYPE OF EMPEROR MANDARIN.

this feature is necessary, and particularly so in light soils. In volcanic soils shallow-rooting annual grasses offer a fair medium. In light land there is no occasion to select areas with defined slopes, and a cover crop of Mauritius bean, mat bean, or cow-peas (worked under in the green stage before maturing seed) is considered very beneficial in respect of providing nitrogen as well as humus. Fertilizing may be required to ensure a heavy cover crop, but as this is returned to the soil in the ploughed-in material, its utility is increased rather than diminished in the process. Frequency with which the land should be worked will vary according to circumstances, including rainfall, but when not under crop, to prevent wash or provide green manure, a fine tilth of a depth of 4 to 5 inches should be maintained. The maintenance of an even surface should be general and with no open furrows; where ploughing is practised, this must be rectified by throwing back a few furrows and harrowing level. Disc implements are recommended in preference to other makes, excepting where perennial weeds, instanced in couch grass, are to be eradicated, when other types of cultivators are more effective. Except for working in fertilizer, a disc cultivator meets all requirements and gives most satisfactory results. The spring tooth has its advocates, but has the disadvantages of rising over hard patches and throughout bringing the root ends where broken by its action towards the surface. The tendency of the disc is to cleanly cut the small surface roots and prevent their undesired formation.

Usually trees come into bearing the third or fourth year from planting. Some varieties are prone to over-production in earliest stages, and the young fruit should be thinned or entirely removed, otherwise the growth is likely to become impaired and result in a stunted tree. Under fair conditions at the fourth season from planting, trees should carry a few fruit, and at the fifth sufficient to pay for their cultivation. The grape fruit and lemon usually come into bearing earlier than other varieties. Though an even supply of moisture is desirable throughout the season to develop the fruit, excess does not benefit it. An excess of moisture results in rather insipid fruit, which is soft and much more susceptible to injury, also attack of various fruit rots that would not have developed in a drier atmosphere. In the drier districts rainfall is seldom sufficient to maintain the necessary soil moisture; and that citrus growing be a profitable proposition, irrigation is essential. Some of the finest lemons, mandarins, and oranges placed on local markets (not omitting the products of Southern Europe and U.S.A.) are produced in the Gayndah district, where the alluvial flats and the waters of the Burdekin River offer exceptional facilities for general citrus culture. Slight disadvantage of the distance in transport is far outweighed by the many advantages naturally provided.

Colouring.

No fruit should be gathered from the tree until it has reached a reasonable stage of development. Lemons should be gathered when their full size is attained, even though change in colour is not apparent, but in most districts reasonable colouring of orange and mandarin should be allowed, dependent to some extent on the variety, for it should be remembered that though the fruit may colour after being taken from the tree, there is no development of sugar content, and a sour orange when picked will continue to remain so. With grape fruit, full colouring should take place on the tree, otherwise the bitter flavour present in early stages will remain pronounced.

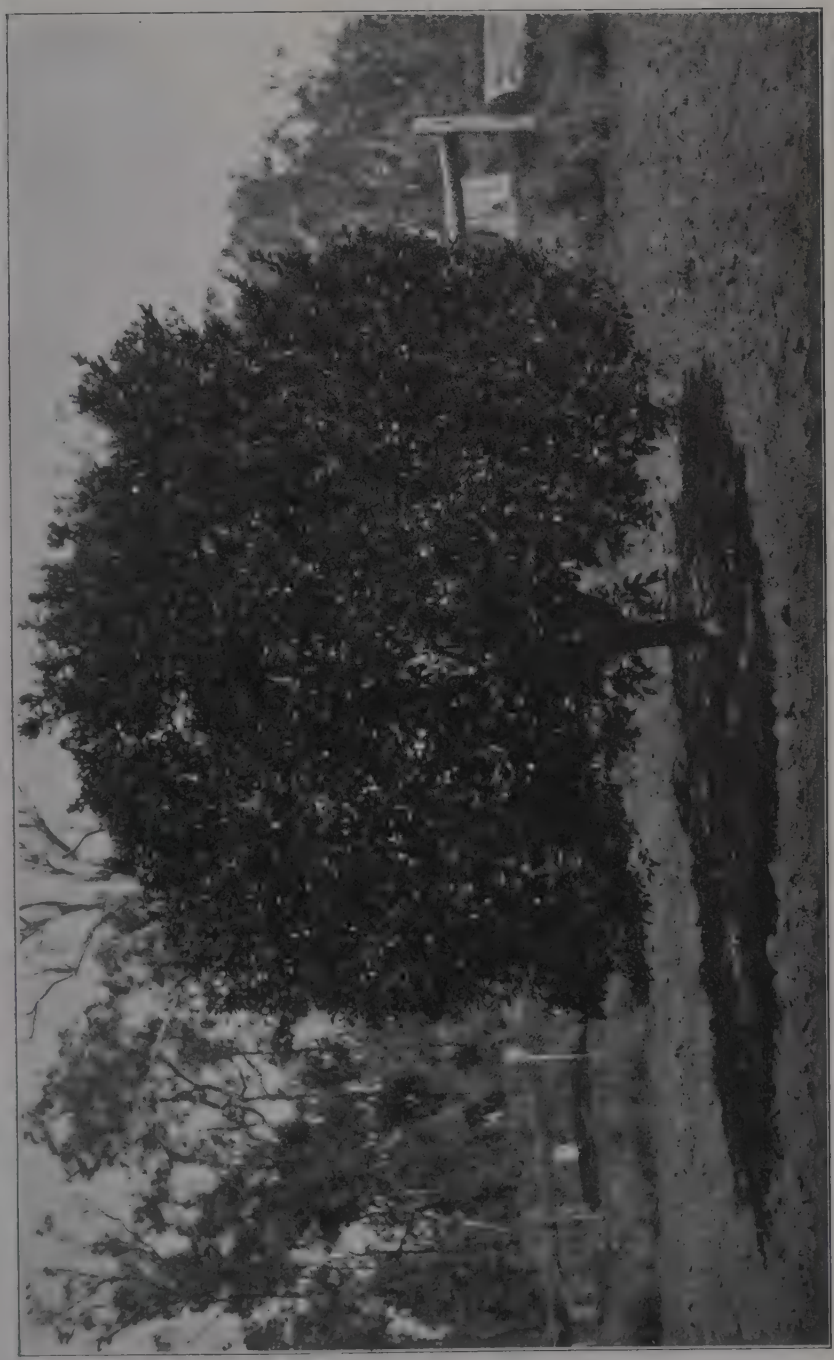


PLATE 132.—TYPICAL PRODUCTIVE SCARLET MANDARIN TREE—AVERAGE PRODUCTION 10 BUSHELS PER ANNUM.

It must be obvious to all that well-coloured oranges and lemons will command a higher price on the market than those in a semi-green state. This would apply to a much greater extent on the Southern markets.

Queensland growers no doubt realise that their fruit is fit for domestic purposes many weeks prior to attaining the degree of colouring that the market desires. Citriculturists who have had experience in various citrus-growing localities will agree that oranges growing in the cooler regions have ample colour long before they attain sufficient sugar to make them desirable for eating purposes, while those produced in warmer climates are sweet and luscious for some time prior to taking on the deep orange appearance which commands the higher price on the market. There is ample room in the Southern States for the production of fruit for the late market, and as the producing cost is somewhat less in those districts, the Queensland grower would be well advised to devote his attention chiefly to the supply of early fruit, and consequently he would reap the advantages of the high prices prevailing in the early part of the season.

COLOURING CITRUS FRUITS.

By R. L. PREST (Instructor, Fruit Culture).

For colouring citrus fruits ethylene gas has superseded carbon dioxide. The method of treatment with ethylene gas is as follows:— The fruit on reaching their full size develop a number of minute yellow or orange-red coloured bodies in the outer cells of the rind. At first these are overshadowed by the green of the chlorophyll present, but as the ripening proceeds the skin loses its green colour and the yellow or orange pigments in the rind show up. Under natural conditions these changes are affected by climatic conditions. Excessive moisture retards the colouring process, which is particularly noticeable in Valencia lates. Even when coloured rain or over-irrigation tends to turn them green again. Cold weather apparently hastens the colouring process.

As citrus fruits are only sold to their best advantage when mature, full flavoured, and showing an unblemished skin with its normal ripe colour, any assistance in colouring such fruit as lack their normal colour but possess the former qualities will enhance the market value. In some districts such varieties as the Navel and Joppa oranges and Emperor mandarin have the desired qualities but lack the normal ripe colour. Lemons, when of a desirable size and mature, should be picked when dark green in colour. Light green lemons may be of equally good quality, but do not possess the carrying quality, whilst tree ripened or coloured lemons are usually thick-skinned, with a poor juice content.

The colouring or forced curing, a practice known in California as sweating, was formerly done by gaseous products generated from kerosene stoves. In 1924 Denny found that ethylene gas in small quantities was capable of producing the same results. He found, however, that a very high percentage of gas (80 per cent., for example) delayed colouring. Colouring was also delayed by as high a temperature as 92 deg. Fahr. and by as low a temperature as 45 deg. Fahr. A temperature of between 60 and 70 deg. Fahr., with a humidity of about 70 per cent., was considered satisfactory.

Any ordinary room lined with timber, gas-tight, and having adequate means for ventilation, may be used. It should have an inspection port

fitted in the door or a suitable wall so that a thermometer reading can easily be taken without opening up the chamber. An ideal room would be one that is lined inside and outside and insulated with sawdust.

Ethylene gas can be obtained in a metal cylinder at a high pressure. A regulator valve is connected to the cylinder. The gas passes into the regulator valve, where it is held until release. It then passes through tubing attached to the regulator valve into the room. The quantity of gas passing into the room is recorded by the regulator valve, so that the correct charges, according to the size of the chamber, may be given.

Fruit to be gassed should be loosely packed in open cases, having plenty of ventilation. Dunnage should be used in stacking in order to have an air space round each case. The chamber should then be closed, making sure that it is airtight. Insert the tubing through a suitable hole made for the purpose and give the required charge. Remove the tubing and plug the hole. Allow the room to remain closed for at least four hours, when it may be opened up and ventilated in such a manner as to replenish it with fresh oxygen. After a thorough ventilation the room may be recharged at once, but it is advantageous to allow it to stand without gas for at least two hours.

About 1 to 1½ lb. pressure per 1,000 cubic feet of room space is the maximum required in an airtight room for successful colouring. Other conditions favourable, it seems to take a very slight amount of gas.

The following points should be observed when colouring mature lemons, oranges, and mandarins:—

Lemons.

Room temperature, 60 to 70 deg. Fahr. Applications, two per day. More may be given if desired. Time, from three to five days. The colouring process will continue after the fruit is removed from the room, providing the process has been properly applied.

Oranges and Mandarins.

Room temperature, 70 to 80 deg. Fahr. Three applications per day are generally considered sufficient over a period of three to four days. When the temperature is high the humidity should be kept up. The reading of the wet bulb should not be more than 10 degrees below the reading of the dry bulb.

Humidity can be increased by placing wet bags or an open vessel containing water in the room, and decreased by placing sand, quicklime, or caustic soda in the room, moisture being thus absorbed.

The sweating of citrus fruits only assists in the colouring process, and has no effect on the maturing or sugar contents. Growers must, therefore, exercise great care when picking.

The subject of careful handling of all fruit has been so frequently stressed that further details seem superfluous. The chief points to be remembered are that the fruit be cut from the tree as close to its base as can conveniently be managed (an orange clipper specially made for the purpose is available at a nominal cost); that it be treated as fragile in the first and all subsequent handlings, carefully stored and graded before packing. Various makes of graders are obtainable, and selection can be made according to the output of the orchard. Wrapping first-class fruit enhances its value, besides providing other advantages. Fruit

should be gathered under driest possible atmospheric conditions. It should be retained at least seven days before casing, and carefully examined at packing so that no specimens containing fruit fly are included.

Standard bushel cases are prescribed market containers and, though the original flat packer with its central division has many advocates, the adoption by Victoria of the 18 by $7\frac{1}{8}$ by $8\frac{2}{3}$ half-bushel case for citrus tends to put this type of case practically out of use; the tendency is not deprecated. For the softer mandarins, in the production of which Queensland by far excels the other States, also in regard to quality, the dump bushel is not considered the most suitable, but the half-bushel meets their requirements admirably. It should be recognised that the general "get-up" of the fruit for market is almost as important as quality. The sale of otherwise excellent fruit of good appearance is too frequently handicapped by indifferent grading or packing, also the inclusion of odd blemished fruit and the use of second-hand cases for local market has a more baneful influence upon sales than is recognised. Cases should contain one variety, and be legibly marked with the name of such, graded according to size and blemishes. Blemished fruit should not be included amongst that which is entirely free from external markings of the skin. Blemishes may arise from various causes—limb rub, fungi, including scab, black brand and melanose (the latter being the most general), and insect injury, including the discoloration due to Maori. The practical elimination of blemished fruit can only be effected by maintaining the trees in a healthy condition, and the greatest concern is how this can be effected at a minimum of expense and labour. Despite all care and attention that may be bestowed upon the orchards, "disease" sooner or later will make its appearance, and a keen faculty of observation should be applied so that its presence may be noted in the earliest stages. Very much influence against disease is exercised by the application of the necessary cultivation and fertilizing, and though pruning may sometimes be referred to as superfluous, its advantages are manifold. Trees should be maintained in the best possible condition that they may ward off attack or be less influenced thereby.

Lemon Curing.

Lemons carefully handled and gathered from the tree at the right stage of maturity may be successfully cured and stored on the orchard for several months without deteriorating, but rather with improvement to their appearance and keeping and edible qualities.

The fruit should be clipped (not pulled) from the trees, with not more than one-eighth of an inch of the stalk remaining, just as it is commencing to show colour, and in order to avoid injuring or bruising and thereby leaving the fruit open to the attack of moulds, it is important to remember that it must at all times be handled with the very greatest of care. When gathering the fruit from the trees, pickers should wear a basket or box slung in front of them by a strap round the neck, with another round the waist to steady it. The handiest size for this receptacle is about one-third the capacity of a kerosene box. Careful growers will pad the inside with some suitable material as an extra precaution. After picking, the fruit should be placed in a shed or other shaded place and allowed to remain for several days to "sweat" off excess moisture from the rind. During this time, unless conditions are very dry, beads of moisture will appear on the surface of the lemons, and before they

are placed in the storing material they must be thoroughly dried with a cloth. If the lemons are not sweated they will tend to become unnecessarily damp in storage and more liable to infection by moulds.

There are several materials which may be used for storing the fruit, the best of which are sand, sawdust, and chaff, though, in the case of the latter, the fruit should be first wrapped in tissue paper. They may be either stored in boxes or in layers on the dry floor of a shed. A layer of whatever material is to be used is first laid down about 2 inches deep, and a single layer of lemons placed on this so that no two fruits are touching. The layer of lemons is then covered with an inch or so of the storing material, and then another layer of fruit, and so on until there are several layers of fruit. Where the fruit is stored in boxes it is advisable to first line the boxes with paper. The fruit should be inspected periodically, and all which show signs of decay removed and burnt.

During curing the colour of the fruit changes from green to yellow and becomes smoother and thinner in the rind. The texture of the fruit also is improved, and a larger percentage by weight can be expressed as juice than from uncured lemons.

Pests and diseases are dealt with in special publications issued by the Entomological Branch. The cost of spraying materials is becoming a decided oppression, and under existing conditions there appears little prospect of alleviation. Though the efficacy of standard brands of spraying oils, plain and emulsified, is not questioned, the advance in prices is sufficient to warrant investigation and experiments for a suitable substitute. It would be superfluous to enter into details regarding the benefit derived from the proper application of insecticides and fungicides. Prior to the advent of the miscible oils now in general use, kerosene emulsion and various formulæ in which resin was the principal or the only destructive agent were used. A serious disability in connection with kerosene emulsion was the tendency, by running down the main stems, to impregnate the soil, to a depth up to 12 inches in the immediate vicinity of the tap root, sufficiently to completely destroy the bark and consequently the tree—the injury not showing above ground until the damage was complete. The effect was much more pronounced in soils which, under dry conditions, had a tendency to slightly contract from the tree, though equal injury has been noted in fine light soils. Bandaging the trunks with absorbent material to absorb the excess of emulsion in its descent was not efficacious, but, where the soil was fine and dry, heaping it around the main stem so that the liquid was distributed over a wider area and away from the tree base materially prevented injury. The covered portion of the stem would be sprayed lightly after the soil had been removed.

Resin wash formulæ, containing a varied proportion of resin, from 1 lb. to 3 gallons of water to 1 lb. to 8 gallons, caustic soda being used in dissolving the resin, and a small quantity of fish oil included, were mainly used before the advent of miscible oils. The concentrated solution entails constant attention whilst being boiled, and in application resin washes are at least unpleasant. Unless the solution is applied hot the pump valves are apt to stick and the distribution is poor. The action of resin wash is that by covering the insect both air and moisture are excluded and the pest smothered. The effect upon citrus trees of continued spraying with resin was found to be detrimental, for in addition to smothering the insect, the foliage was for some time subsequent to the operation subjected to the same influence. If the weight

of costs compels reversion to early methods, kerosene emulsion with the addition of a small quantity of resin (1 lb. to each gallon of kerosene) is recommended. This necessitates the use of soft soap, also boiling. One quart of soft soap and 1 lb. of finely powdered resin boiled in 2 quarts of water (or in larger quantities of these proportions) should be slowly boiled until the resin is dissolved (about forty-five minutes). After removing from the tin, up to 2 quarts of kerosene should be added whilst the mixture is still boiling hot and agitated with a pump for a few minutes, when the emulsion will be complete. The emulsifying process is much improved if a little ammonia is added with the kerosene. For application this is diluted so that approximately one-sixteenth of the liquid is kerosene, the amount varying under different circumstances. Few of the formulæ now recommended for the destruction of pests will fail to be effective, even if they are slightly modified. The particular points, which cannot be too strongly emphasised, are:—Be on time; make the application at a time calculated to give best results; the destruction of one insect may mean the destruction of hundreds, and one application at the right time frequently means protection against innumerable spores of fungi which are endeavouring to gain a foothold; be thorough; when spraying a tree spray it well; the operator will be regarded only to the extent which he has been painstaking; apply sprays intelligently—this is the most important factor in the work.

The line of treatment against fungi is to cover the stem, foliage, and fruit with some substance which will destroy the spores which may be present as soon as they germinate, or have the power of preventing this germination. That the applications be thorough and economically and evenly applied a good outfit is indispensable. In established orchards of large trees a power sprayer is a necessity. It is most useful amongst younger trees, but the cost may not be available, when barrel pumps are relied upon. Good results will attend the expenditure of labour in maintaining a good pressure, without which the results cannot be satisfactory.

Fumigation.

The cost of suitable sheets for covering trees for fumigating with cyanogas (which has supplanted soda cyanide) is excessive, particularly in view of the condition of cotton markets. A complete outfit is beyond the means of the average orchardist to purchase; but when the present cost of spraying material, including pumps, general efficacy, and effect upon the trees are considered, fumigation will show the most favourable aspect. There is no apparent reason why each association or combination of growers in any productive locality should not procure an outfit of sheets of dimensions sufficient to meet local requirements, and this feature is again commended for consideration. Trees which have been sprayed with Bordeaux mixture should not be fumigated until at least three months have elapsed. Where lime sulphur spray has been applied it should not be followed by oil sprays for a minimum of six weeks.

The cost of establishing a citrus orchard varies according to location and local circumstances. If fertile scrub lands, where stumps are not removed, the expense of preliminary work would be much less than in forest land. Apart from the cost of land, fencing, and building, the expense in forest land is estimated at—

Clearing and running roots to a depth of 16 inches, £14 to £26 per acre.
Ploughing, subsoiling (to 15 inches), and cultivating, £7 10s. per acre.
Trees (75) and planting £8 per acre.

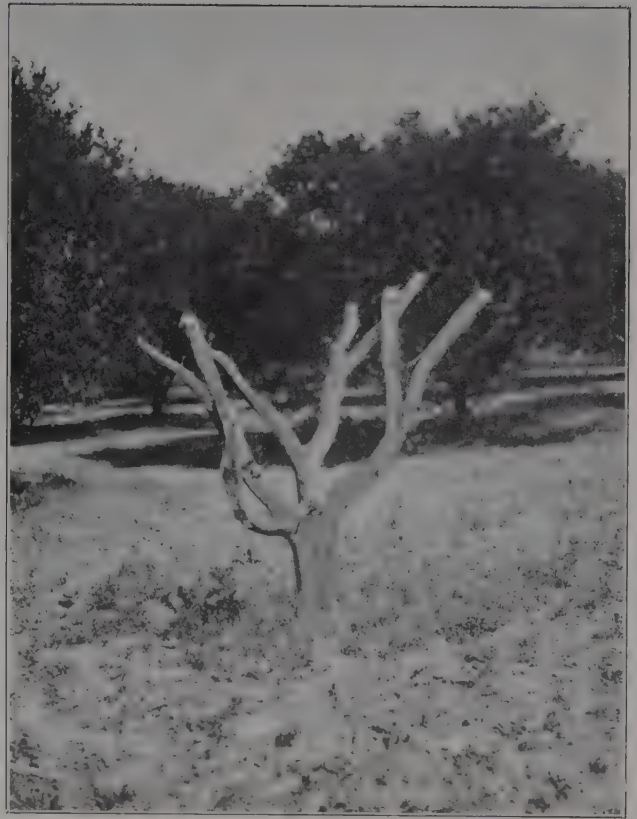


PLATE 133.

1. AN UNPRODUCTIVE SCARLET MANDARIN TREE.

2. THE SAME TREE HEADED BACK FOR WORKING OVER AFTER NEW GROWTH DEVELOPS. (NOTE YOUNG SHOOTS STARTING.)

Roughly an average of £36 per acre, to which must be added, for subsequent cultivation and attention, the necessary implements and horse (or horses), spray pumps, and tools. The cost of maintenance will depend upon the system adopted—whether the interspaces are utilised for growing small crops, and the nature of such crops, or clean cultivation is maintained throughout.

Plate 134.—Byfield Seedless Oranges.

Working Over Trees.

The method adopted in working over grown trees which have proved unprofitable is to remove the head of the tree during the winter when the tree is dormant by cutting back all branches to within 2 to 5 feet of the trunk, according to the size of the tree, and leaving only a sufficient number to form a new head.

During the spring numerous shoots will start from the branches remaining, and these may be thinned out after the first growth has hardened to three or four suitably placed near the end of the shortened branch. Later these can be reduced to two. When the shoots are about 6 inches long the terminal growths should be nipped out to lessen their chances of being blown off by the wind, and also to "stiffen" the growth. During the following autumn the trees will be ready for budding, which is done on the young shoots, or they may be left until the next spring. Trees worked over in this manner will carry a crop of fruit two years after working, and will rapidly attain the same dimensions as the original tree.

In some publications it is recommended that in heading back trees at least two branches be allowed to remain to act as draw branches to maintain the vitality of the tree. This may be necessary if heading back is done at a period when the tree is in growth or, in other words, at the wrong time of the year; but when the heading back is done during the winter, when the growth has terminated, the whole of the top may be safely removed without fear of the tree dying back; in fact, better results can be obtained when no "draw branches" are left and the future shape of the tree can be more readily formulated.

CLIMATOLOGICAL TABLE—SEPTEMBER, 1931.

COMPILED FROM TELEGRAPHIC REPORTS.

Districts and Stations.	Atmospheric Pressure. Mean at 9 a.m.	Shade Temperature.						Rainfall.	
		Means.		Extremes.				Total.	Wet Days.
		Max.	Min.	Max.	Date.	Min.	Date.		
Coastal.	In.	Deg.	Deg.	Deg.		Deg.		Points.	
Cooktown	30·01	84	72	86	15, 18, 19, 28, 29, 30	62	3	31	3
Herberton	..	79	56	87	3	48	2, 3	26	4
Rockhampton	30·08	82	61	91	15	55	5, 18	275	5
Brisbane	30·09	76	56	86	14	45	1	90	7
Darling Downs.									
Dalby	30·06	77	49	91	15	35	1	147	7
Stanthorpe	..	68	42	80	25	27	1, 3	234	9
Toowoomba	..	71	47	85	15	33	1	137	8
Mid-Interior.									
Georgetown	29·98	91	64	98	10	46	5	471	2
Longreach	30·01	86	56	99	15	43	4, 5	108	3
Mitchell	30·04	80	48	92	15	35	5	23	3
Western.									
Burketown	29·98	90	66	97	28	56	5	0	..
Boulia	30·00	87	56	98	14,25,29	49	1	65	4
Thargomindah	30·02	78	50	95	25	37	9	27	3

RAINFALL IN THE AGRICULTURAL DISTRICTS.

TABLE SHOWING THE AVERAGE RAINFALL FOR THE MONTH OF SEPTEMBER, IN THE AGRICULTURAL DISTRICTS, TOGETHER WITH TOTAL RAINFALL DURING 1931 AND 1930 FOR COMPARISON.

Divisions and Stations.	Average Rainfall.		Total Rainfall.		Divisions and Stations.	Average Rainfall.		Total Rainfall.	
	Sept.,	No. of Years' Records.	Sept., 1931.	Sept., 1930.		Sept.,	No. of Years' Records.	Sept., 1931.	Sept., 1930.
North Coast. ..	In.		In.	In.	*South Coast*—continued:	In.		In.	In.
Atherton	0·66	30	0·31	0·71	Kilkivan	1·70	52	1·57	0·85
Cairns	1·69	49	0·72	1·21	Maryborough ..	1·92	59	0·75	0·98
Cardwell	1·53	59	0·65	0·46	Nambour	2·53	35	2·03	1·26
Cooktown	0·59	55	0·31	0·45	Nanango	1·79	49	2·67	1·16
Herberton	0·49	44	0·26	0·36	Rockhampton ..	1·31	44	2·75	0·24
Ingham	1·50	39	1·18	0·80	Woodford	2·18	44	1·81	1·52
Innisfail	3·55	50	2·02	1·24					
Mossman Mill ..	1·44	18	1·22	0·48					
Townsville	0·83	60	0·32	0	*Darling Downs.*				
Central Coast.					Dalby	1·68	61	1·47	0·92
					Emu Vale	1·74	35	1·10	1·54
Ayr	1·45	44	0·27	0	Jimbour	1·49	43	1·60	0·78
Bowen	0·83	60	0·28	0	Miles	1·36	46	0·53	0·78
Charters Towers ..	0·75	49	4·13	0·21	Stanthorpe ..	2·28	58	2·34	1·02
Mackay	1·59	60	0·97	0·07	Toowoomba ..	2·14	59	1·37	1·47
Proserpine	2·17	28	0·08	1·81	Warwick	1·80	66	1·79	1·33
St. Lawrence ..	1·25	60	5·05	0					
					Maranoa.				
South Coast.					Roma	1·44	57	0·32	0·06
Biggenden ..	1·54	32	1·35	1·45					
Bundaberg	1·64	48	0·83	1·54					
Brisbane	1·99	80	0·90	0·95	*State Farms, &c.*				
Caboolture	1·85	44	1·49	0·73	Bungeworgorai ..	0·97	17	0·18	0·13
Childers	1·80	36	2·15	1·64	Gatton College ..	1·56	36	0·83	1·15
Crohamhurst ..	2·59	38	1·81	0·21	Gindie	1·04	32	1·17	1·01
Esk	2·15	44	1·10	1·58	Hermitage ..	1·48	25	1·32	1·28
Gayndah	1·57	60	1·16	2·40	Kairi	0·65	17	..	0·52
Gympie	2·11	61	1·10	2·00	Mackay Sugar Experiment Station	1·49	34	0·31	0·18

J. H. HARTSHORN, Acting Divisional Meteorologist.

The Young Farmer.

LESSONS IN PIG RAISING.—II.

(Prepared by Officers of the Department of Agriculture and Stock.)

SELECTION OF THE PIG.

In selecting the pig the requirements of both the consumer and the grower must be considered. The market requires pigs of certain definite weights, and with long, smooth bodies, well developed and rounded in the hindquarters, comparatively long in the sides, and light and fine in the shoulders, neck, and head. The legs should be moderately long and fine, denoting fine quality, light bone throughout the carcass. The skin and hair should be fine and smooth, showing quality. Pigs, when marketed, should be in hard, fleshy condition, and not excessively fat.

The pig-raiser wants the pig which will grow rapidly on little food, resisting disease and parasitic infestation, and which, if retained for breeding purposes, will be capable of producing large numbers of good young pigs. This class of pig should come from a large litter, and be the progeny of a large boar and sow which show plenty of quality and character. The pig, when weaned, should be well grown in comparison with its litter mates; it should be vigorous and rather lengthy in type; a young pig which has short legs and a short, thick-set body, with heavy shoulders, does not grow into the best class of animal. It is preferable to select the lengthy pig, as it should develop into a long, lean, and fast-growing porker or baconer.

There should be more certainty of getting a good pig from pedigree stock bred true to type and improved for many generations than from inferior or mongrel breeding stock.

Questions.

(1) When selecting a pig, what requirements must be considered?
(2) Describe the type of pig the bacon trade requires.

DAIRY FLOORS.

A report was received just lately from a dairy farmer that he had met with failure in attempting to grout between the bricks on the floor of the milking-shed. He tried three different brands of cement, using mixtures of 4 to 1 with toppings, 3 to 1 with sand, 3 to 1 with stonedust, and he even used neat cement, all with the same result—the mixture failed to harden; in fact it was like mud. A member of the technical staff of the association was sent out to investigate and give the farmer some helpful advice. The first thing he discovered was that the bricks themselves were the seat of the trouble. They were hand made bricks, obtained about forty years ago. Several of the bricks were taken up and cracked open. There was a strong, stale smell of decomposed organic matter, which had soaked into the bricks with the continued washing down and sweeping twice daily after milking. The decomposed organic matter had such strong effect on the cement that the usual setting properties were altogether destroyed.

This was the way in which the job was fixed up: First, the whole floor was swept clean, using plenty of fresh water. Then the bricks were chipped all over with an ordinary pick and light crowbar, so that the surface was made rough and as many corners knocked off as possible. Next the floor was washed over, using a strong solution of caustic soda, followed by plenty of water to remove all traces of the caustic soda. Then a mixture was made up of two parts of clean sand to one part of cement, and applied as a thin grout over the whole floor, using a stiff yard broom. It was allowed to dry out for one day. The effect of the decomposed matter in the porous bricks was still noticeable. It affected this thin wash to some extent, yet at the same time a protective coat was obtained. Over this coating a layer of concrete, 3 in. thick, was spread. The mixture consisted of one part of cement, two and a-half parts of clean, washed sand, and four parts of bluemetal screenings. The surface of the concrete was not trowelled; it was merely ruled off with a straight piece of wood, leaving a coarse, rough surface, upon which the cows will never be likely to slip. At the same time, the milking shed now has one of the best floors in the district. As soon as it is washed over after milking it is perfectly clean. Concrete is not porous; it does not soak up any of the organic matter, and the old stale smell has gone for ever.

Answers to Correspondents.

Fungus.

S.E.S. (Summerhill, Beaudesert Line)—

Mr. R. B. Morwood, Assistant Pathologist, advises that the fungus is a species of Clathrus, one of the Phalloids or Stinkhorn fungi. Owing to its objectionable smell it is inedible, but it is not recorded as being poisonous. The objectionable smell previously referred to originates from the decomposition of certain issues of the fungus. It would probably be as dangerous to consume this as it would be to eat decomposed meat, &c. Domestic animals which avoid carrion would presumably also avoid the Stinkhorn fungi.

The following information is supplied in answer to a number of inquiries:—

White Hide—Tanning Process on the Farm.

As it is almost impossible to enumerate the uses to which good white hide may be put, especially on a farm, the necessity for careful selection of the hide to be treated cannot be too greatly stressed.

The ideal hide for general purposes such as harness repairs, leg ropes, cart and sulky reins, bridles, bullock whips and falls, straps of all sizes, &c., is that of a fat, four-year-old, whole colour steer or heifer, the latter being slightly finer.

If a thinner and much finer quality hide is required, a four to six year old whole colour Jersey female in good condition will produce it. Hides to be carefully avoided for farm tanning are those of spotted or low-conditioned animals, of whatever breed or age. In the former case it has been conclusively proved that, wherever there is a white patch the hide is thinner, and good work cannot be done with a hide of varying thickness; in the case of poor animals the hide is practically useless. Before killing have ready a well-scoured cask (a 40-gallon one will hold any hide), put in about 16 gallons of water and a good half-bucket of slaked lime. This is to loosen the hair and neutralise the fat. Bleed the animal, first from the heart, then sever both artery and jugular vein in the neck. Have the head slightly down hill if possible when sticking. Skin the animal carefully, as a bad score or cut may spoil an otherwise good strip of leather. While warm skin off as much waste fat and flesh as possible. Trim off scraggy leg and belly points, and lay the hide out flat on a clean floor in the shade and allow it to become cold.

Then stir the water and lime in the barrel and lower the hide slowly into the liquid to prevent the formation of air pockets, poke down and stir again. Weigh down with wood any part that comes to the surface. Do this once a day, or more frequently until the hair begins to come off. Throw the hide over a barrel on a flat surface and scrape both sides clean with skinning and/or fleshing knife. Be careful not to mark the hair side of the hide with the knife. If all the hair does not come off at first, put back for a day or two. Empty and sluice the cask; about half fill it with clean water and leave the hide in it while preparing the curing solution. Dissolve 8 lb. of salt, common or coarse, in half a kerosene tin of boiling water; leave to cool. Dissolve 4 lb. of powdered alum in half a kerosene tin of boiling water and leave to cool. Mix 8 lb. of white flour into a thin paste, free of lumps. The best way to do this is to put about 2 lb. of flour into a kerosene tin and mix into a stiff paste with cold water, add a little more water; stir briskly with either the hands or a stick. Repeat this until the tin is about half full. The hide can now be thrown over a fence or the like to drain. Empty the cask and put the flour paste in. Mix more flour as before up to 8 lb. and add to that in the cask. When the alum and salt solutions are cool, add the flour paste and mix thoroughly. Allow to stand over about fifteen minutes and mix again. Lower the hide as before and add just sufficient clean cold water to cover. Poke down with a heavy stick until you are sure that all air is out and weight with wood any portion that comes to the surface. Leave for two days. Stir at least once a day for three weeks. Take care each time to stir right down from the bottom, get all the air out and weight it down as before. Do not allow iron to come into contact with the hide when in the solution, as it will leave an indelible rust patch.

When the time is up, hang the hide in the shade, throw a few buckets of water over each side and leave for about half a day, reversing it occasionally. Spread on a flat surface, and rub in with smooth-ended piece of wood equal parts of common tallow and neatsfoot oil on one side only, using plenty. Leave for a few hours if convenient, then roll up as tightly as possible. Wrap up in bags and leave for a few days when it will be ready for use.

BOTANY.

The following answers have been selected from the outgoing mail of the Government Botanist, Mr. C. T. White, F.L.S.:—

Wart or Bitter Cress.

T.A.N. (Gympie)—

The specimen is the Wart Cress or Bitter Cress, *Senebiera didyma*, a common European weed naturalised in most warm temperate countries. It is quite common in Australia as a weed, particularly during the early spring months. It taints milk very badly, but is, however, rarely seen in pastures, being essentially a weed of cultivation.

Bindweed.

F.O.B. (Gatton)—

The specimen is *Convolvulus arvensis*, the common Bindweed, a native of Europe, now naturalised as a weed in most temperate countries. In Queensland up to the present instance it was, so far as we know, confined to a few isolated patches on the Darling Downs. It is one of the worst weed pests so far introduced into Queensland, and should be eradicated as far as possible on its first appearance. It produces a large number of underground running roots, almost any small part of which, when cut, is capable of forming a new plant.

Tea. Fennel Flower. Asafoetifa. Barberry.

W.E. (Beaudesert)—

1. The Tea plant, *Thea sinensis*, is grown as an ornamental shrub in a few places. If you wrote to Mr. G. Rankin, Bonnie Brae, Beechmont, he would probably give you seeds, as he has some shrubs in his garden which set seed quite freely. We do not, however, know of the particular variety he has nor anything of its value for ordinary tea.
2. Paraguay Tea, *Ilex paraguayensis*. The true Paraguay Tea is not growing anywhere in Queensland so far as we know. Some trees labelled Paraguay Tea in the Brisbane Botanic Gardens and other public parks proved on examination to be something totally different. The Department of Agriculture has imported seeds from South America at odd times during the past few years, but the seeds so far have always failed to germinate.
3. Fennel Flower. *Nigella* is commonly known as Fennel Flower, but the common Fennel, of which the young leaves are used for flavouring the seeds for the expression of an aromatic oil is *Fœniculum officinale*, which is quite commonly naturalised as a weed on the Darling Downs between Toowoomba and Warwick. It sets fruit about February or March.
4. Asafœtifa is not obtainable in Queensland. You might be able to get seeds from the Botanic Gardens, Melbourne, but of this we cannot be sure.
5. Barberry, *Berberis vulgaris*. This is occasionally seen as an ornamental shrub in gardens on the Darling Downs at Toowoomba and Warwick. We do not know where you could obtain seeds in Queensland. The Botanic Gardens, Melbourne, might be able to supply you with some or put you in touch with a supplier, as we think it is grown there as an ornamental shrub to a moderate extent.

Foam Bark.

W.K.H. (Townsville)—

The specimen is not the Peach Poison Bush, but the Foam Bark (*Jagera pseudorhus*). The bark of this tree has been used as a substitute for Quillaja for putting a "head" on beers and soft drinks. It has not come under suspicion as a poisonous plant, though it is very common in coastal scrubs in both North and South Queensland.

Spider Wort.

F.D. (Maleny)—

The plant bore no flowers, but is one of the Commelinaceæ or Spider Wort family, we should say *Commelina cyanea*, the commonest member of the family in Queensland. Plants of this family are not known to be poisonous or harmful in any way, and, in fact, some of them have been used as greens in cases of scurvy and lack of other vegetables at different times. Wandering Jew is a name commonly applied to several plants of this family.

Two Good Fodder Plants.

INQUIRER (Sydney)—

The specimens are determined correctly as *Alysicarpus vaginalis* and *Stylosanthes procumbens* respectively. We have two species of *Alysicarpus, A. vaginalis* and *A. rugosus,* and both are looked upon as very good fodders, particularly the latter. The *Stylosanthes* was originally recorded by F. M. Bailey as *Stylosanthes mucronata.* This species is in Greisbach's "Flora of the British West Indies," given as a synonym of *S. procumbens,* but in the Index Kewensis they are kept apart as distinct species. When this plant was first introduced it was simply looked upon as a pest in lawns in the neighbourhood of Townsville, but now it is regarded in North Queensland as an excellent fodder. Chemical analysis shows its feeding value to approximate to that of ordinary lucerne. When very rank the herb does not seem to be so much favoured by cattle as when it is growing under more adverse conditions. Under moist conditions, where growth is luxuriant, the plant is probably better for hay than for green fodder.

Tea Trees.

INQUIRER (Melbourne)—

Several varieties of *Melaleuca leucadendron* are common in Queensland, forming extensive forests, though the timber is not used to any great extent. The following notes on it are taken from "The Timbers and Forest Products of Queensland," by E. H. F. Swain, a work you could recommend to your correspondent as one he could obtain as a source of information on Queensland timbers. Mr. Swain states:—"The timber is compact, even, fine and short grained, tough and firm to cut, but having the defect of brittleness, and this defect increases with age. It has considerable durability in or out of weather, and is said to be comparatively white-ant resistant. In seasoning it is inclined to check and warp, which defects can be greatly reduced by sawing logs on the commercial quarter and seasoning slowly under cover. Brown Tea-tree is, according to Mr. Norman Wright, boatbuilder, of Brisbane, the most favoured timber for knees in large and small boats under cover. It is very tough. For natural bends or crooks it is better than Brush Box, Red Irongum, Spotted Irongum, or Honeysuckle Oak. It is extensively used for oyster-bed stakes. 'On the Burrum Coalfield,' Mr. C. J. J. Watson writes, 'I saw large areas of tea-tree swamps practically cut out for underground filling-up work, where pillars are made by putting pieces criss-cross from floor to roof in worked-out places where waste shale is being thrown.' With the bark removed it lasts well as a fence-rail, and has a very long life when used in the round, peeled, for rafters. It is being used by the Queensland Railway Department as sawn half-round sleepers for the building of the Mount Isa Railway line. When sawn it makes a satisfactory fruit-case timber, but somewhat hard to nail; and when tested for butter-boxes it imparted no harmful taste or taint to the butter, its weight and the narrow widths available were drawbacks. It is recommended by the Associated Country Sawmillers of New South Wales for veranda floorings. It has some possibilities for wood-carving and carved cabinet work." It was tested by the Council for Scientific and Industrial Research as a source of wood pulp, but was found to be scarcely worthy of consideration as a pulp wood. A disadvantage of the tree is that logs are generally only obtainable in small sizes.

Mushroom Poisoning.

H.S.P. (Stanthorpe)—

The specimens of toadstools were a semi-liquid mass, riddled with maggots when they reached us, hence determinations were impossible. Most mushrooms and toadstools, however, that occur in paddocks in Queensland are not poisonous, but the one that is most frequently reported as such is a tall white one, *Lepiota dolichaulos.* Symptoms of mushroom or toadstool poisoning are that there is often a latent period of from six to twelve hours, the victims remaining quite well. They are suddenly seized with terrible abdominal pains, excessive vomiting, and thirst. Diarrhœa may set in with mucous, bloody stools; on other occasions there may be constipation. A widening of the pupils of the eyes is also a common symptom, and dilation of the bladder with urine.

General Notes.

The Apiaries Act.

The Governor in Council has approved of the issue of a Proclamation bringing "*The Apiaries Act of* 1931" into operation as from the 24th October. This Act was assented to on the 15th October, and was enacted for the purpose of regulating and controlling the keeping of bees, and to control and restrict diseases and pests in relation to bees.

The abovementioned Act provides that the Governor in Council may declare any part of the State to be a district under the Act, and approval has accordingly been given to an Order in Council declaring the Pastoral Districts of Moreton and Darling Downs to be a district for the purposes of the Apiaries Act.

Protected Orchids.

It was noticed recently that there have been for sale in Brisbane some sprays of the large Phaius Orchid (*Phaius grandifolius*). The Department of Agriculture and Stock draws attention to the fact that this plant is protected under "*The Native Plants Protection Act of* 1930," and persons picking it on public lands are liable to prosecution under the Act. The flower spikes are several feet long and bear a number of brownish-red flowers with a central lip of a different colour. There is a rarer species with yellow flowers called *Phaius Bernaysii*, and this is also protected under the Act.

Cotton Board.

The Governor in Council has approved of the issue of an Order in Council amending the constitution of the Cotton Board with regard to the cotton districts.

The Order in Council constituting the Board provides that the growers' representatives on the Board shall be elected biennially, and that one representative shall be elected from each of six cotton districts. District No. 1 includes, amongst other areas, the area served by the railway stations on the Boyne Valley Line, excepting Barrimoon and Kalpowar. However, since the cotton districts were drafted, the Boyne Valley Line has been extended, and it is now necessary to alter the wording in District No. 1 to make clear that all stations on the line as far as and including Golembil shall be included in that district. The wording in No. 4 district also required amendment so as to indicate clearly that the stations from Monto to, and including, Barrimoon and Kalpowar on the Boyne Valley Line, should be included in District No. 4. The Order in Council issued, therefore, amends the wording in cotton districts Nos. 1 and 4.

A Poultry Mite Infesting Dwellings.

At this time of the year house infestation by a poultry mite, commonly known as the tropical fowl mite, is fairly frequent, said Mr. F. H. S. Roberts, of the Entomological Branch, Department of Agriculture and Stock, in the course of a recent radio address from 4QG. This mite is usually found associated with the domestic fowl, on which at times it occurs in very large numbers. House infestation is brought about mainly through the agency of house-frequenting birds such as the sparrow, starling, and pigeon, which pick up the mite from infested poultry yards. When these birds leave their nests in the eaves and ceilings after the young have been reared, the mites scatter over the house in search of food. Their bite is painless, but it leaves an intensely irritable area, causing acute itching. The first measure in the control of these pests is to locate and remove the nests of the birds from which they are coming. The infested portion of the affected premises should be thoroughly sprayed with an efficient insecticide. The bite may be relieved by bathing with a weak carbolic solution and applying an ointment composed of Beto. naphthol 15 parts, lard 100 parts, green soap 50 parts, and lanoline 10 parts. The mites may also become prevalent in a house from an adjacent poultry yard or from caged birds, such as parrots and canaries. Attention to cleanliness in these quarters and painting the perches with a solution of nicotine sulphate or blackleaf 40 will soon eradicate the pests.

Beef for the British Army.

The Minister for Agriculture and Stock has received a cablegram from the Agent-General's Office, London, to the following effect:—"War Office inviting tenders for 1,000,000 12 oz.-tins of corned beef returnable 6th January delivery 30th June next year specifications posted."

Staff Changes and Appointments.

Mr. F. P. Delf, of Arcadia, Magnetic Island, Townsville, has been appointed an Honorary Ranger under the Animals and Birds Acts.

Mr. Wm. E. Chandler, of Mowbullan House, Bunya Mountains, Dalby, has been appointed an Acting Inspector of Stock under the Diseases in Stock Acts.

Mr. J. P. H. Clark, Inspector of Stock at Wandoan, has been appointed also an Inspector under the Slaughtering and Brands Acts.

Mr. Robert Shepherd, Chairman of the Proserpine Co-operative Sugar Milling Association Limited, has been appointed Millowners' Representative on the Proserpine Local Sugar Cane Prices Board, vice Mr. C. C. Dodd, resigned.

Mr. S. R. C. Harding, of Timor, Injune, has been appointed an Honorary Inspector under the Diseases in Stock Acts.

Mr. Henry Hacker, F.E.S., Entomologist, and Mr. R. B. Morwood, M.Sc., Assistant Pathologist, Department of Agriculture and Stock, have been appointed also Inspectors under "*The Apiaries Act of* 1931."

Broom Millet Board.

The time fixed for the lodging of a petition in connection with the extension of the Broom Millet Board for a further term of three years closed on Monday, 12th October, without any request for a poll having been received from the growers. The necessary steps will therefore be taken to continue the operations of this pool as from the 1st November, 1931, to the 31st October, 1934. The present members, Messrs. Hans Niemeyer, Hatton Vale, and Erich Max Schneider, Binjour Plateau, have been returned unopposed and will be appointed to hold office for a further term of one year.

Wheat Conference.

A conference of the members of the State Wheat Board and representatives of the Queensland flour millers was convened by the Minister for Agriculture and Stock (Hon. H. F. Walker) and held recently at the Department of Agriculture and Stock. Those present included—

Representing the State Wheat Board—A. Hoskin (Chairman), H. C. C. Kirkegaard, T. W. McIntyre, W. J. Brimblecombe, A. E. Gibson (Government representative), J. E. Nussey, R. T. Phelps (manager), and J. A. Watson (secretary).

Representing the Flour Millers—R. J. Archibald, H. W. Luya, R. M. White (representing Brisbane Milling Company and Dominion Milling Company), T. P. and E. O'Brien, W. D. Phie (representing Defiance Milling Company), J. H. Allison (Warwick Farmers' Milling Company), G. P. Barnes and W. A. Dean (representing Barnes and Company, Limited), A. Pardy (representing Gillespie Brothers (Qld.) Limited); also

Mr. E. Graham (Under Secretary and Director of Marketing).

The conference was opened by the Minister for Agriculture and Stock, who occupied the chair.

Mr. Walker stated that the conference was held in accordance with the provisions of the agreement entered into by the parties concerned for the purpose of reviewing and discussing certain arrangements that had been made, and to consider any matters that might be deemed to be in the betterment of the wheat-growing and flour-milling interests in this State.

The matters of the reallocation of depots, liability for replacement of bags in feed stacks, appointment, duties, and remuneration of classifiers, fixation of standards of classification, and the acceptance of Currawa wheat by the millers were fully discussed, and decisions mutually arrived at which, it is thought, would be of benefit to the Board and millers concerned.

Another subject that was discussed was the quantity of wheat to be taken over by the millers for the 1931-32 season as provided for in the agreement. No finality was reached on this matter pending an announcement by the Premier relative to the attitude of the Government with regard to the renewal of the conditions now applicable to the wheat-growing and flour-milling industries in this State.

Mr. Walker was of the opinion that the decisions arrived at by the conference would be of material advantage to the harmonious working of the arrangements now existing between the Board and the millers, and of ultimate benefit to the wheatgrowers and those interested in the flour trade of the State.

The Home and the Garden.

OUR BABIES.

Under this heading a series of short articles by the Medical and Nursing Staff of the Queensland Baby Clinics, dealing with the welfare and care of babies, has been planned in the hope of maintaining their health, increasing their happiness, and decreasing the number of avoidable cases of infant mortality.

THE EXPECTANT MOTHER.

How strange it is, when one comes to think of it, that women should enter motherhood—the most important career in the world—without any special training! It should be the aim of every expectant mother to have a strong and healthy baby, and everything that affects the health of the mother affects also the wellbeing of her child. The mother's diet needs special thought for her food is providing the materials for building another body, and they should be the best that can be obtained. The best does not, of course, mean the most expensive. Milk, which is the most important, is also the cheapest of foods. Butter, cheese, and eggs are also among the most valuable of foods, and these four can be combined in many appetising ways. With them can be taken wholemeal bread, and any foods made with whole cereals. In addition, and especially if white bread is eaten, two or three tablespoonfuls of prepared bran should be included in the daily diet. Green vegetables, especially salads, should be eaten liberally every day if possible. Potatoes, carrots, tomatoes, other vegetables and fruits should also form part of the daily fare. Meat should be taken in strict moderation only once daily, and the best meats are liver, kidney, and tripe. We do not say that no other foods than these must be taken, but these are the most important for the building of sound bodies with strong bones and teeth.

A Deficient Diet.

A common Queensland diet consisting largely of white bread and scones, tea, meat, and sweet stuffs, with little fruit, vegetables, or milk, is a deficient diet. It fails to provide the elements necessary for building up the complicated and marvellous structures of the baby's body. The result may be compared to a house which is built out of poor, shoddy materials. It may look all right outside, but it will not stand wear, and is always needing repairs.

Every mother should know that seven months before baby is born the foundations of his teeth have been laid down, and that the building up of his first teeth is completed before birth. If the mother has been on a deficient diet, the milk teeth are of poor quality and soon decay, and this is a sign of weakness in the other structures of the baby's body.

Antenatal Care.

Pregnancy should be a time of increased fitness and wellbeing. With proper food, plenty of fresh air, reasonable exercise, and exposure to sunlight, and a little skilled supervision, almost every mother should have a normal labour and a healthy baby. This skilled supervision, which we call antenatal care, may be obtained from your medical attendant, or from a maternity hospital. In Brisbane we have two Antenatal Clinics open to all, but especially necessary for those who do not engage a doctor. These especially should not fail to attend one of these clinics in order to be assured that they will in all probability have a normal labour.

Use Common Sense.

By taking a little pains, and by making use of the advice which is freely provided, many expectant mothers would be saved from a number of discomforts and anxieties. Some would be saved from dangerous or even fatal illnesses. Many babies which are now born to live only a few days or a few weeks would grow into strong, healthy children if only every expectant mother would use her own common sense, and give a little thought to her own future health and the health of her child.

THE COUNTRY WOMAN.

By arrangement with the Domestic Science and Technical Services of the Department of Public Instruction, information of especial interest to country women is published regularly under this heading.

Text booklets are available, free of cost, on application to that Department.

SIMPLE COOKERY.

SPONGE SANDWICH.

Materials—3 eggs; ¾ cup sugar; 1 cup flour; 1 teaspoonful baking powder; 2 tablespoonfuls cold water; 2 tablespoonfuls jam; dripping; icing sugar.

Utensils—Bowl; whisk; sieve; 2 sandwich tins; knife.

Method—

1. Break eggs into a bowl.
2. Add sugar; whisk till thick.
3. Add flour mixed with baking-powder; add cold water.
4. Bake in two greased sandwich tins.
5. When cooked, join with jam; sprinkle top with icing sugar.

SHEPHERD'S PIE.

Materials—1 lb. steak; 2 teaspoonfuls salt; 2 pinches of pepper; ½ cup water; 6 large potatoes; ½ cup milk; 1 dessertspoonful lard.

Utensils—1 saucepan; wooden spoon; pie dish; potato-masher; knife; fork; mincer.

Method—

1. Pass meat through a mincing-machine.
2. Put meat into a saucepan.
3. Add water, salt, and pepper.
4. Stir with a wooden spoon till meat becomes a brown colour.
5. Add flour; cook for 3 minutes; put into a greased pie dish.
6. Cover thickly with mashed potatoes.
7. Bake in a hot oven till brown.

Potato Top.

1. Wash and peel potatoes.
2. Cut into even-sized pieces.
3. Put into a saucepan; cover with cold water if the potatoes are old.
4. Add salt; boil till tender.
5. Strain; dry; mash.
6. Add hot milk and butter.
7. Mix well with the back of a wooden spoon.
8. Spread on top of meat; make smooth with a knife; decorate with a fork.

BOILED ONIONS.

Materials—1 lb. onions; 1 teaspoonful salt; 1 pint water. For Sauce: 1 dessertspoonful lard or butter; 1 dessertspoonful flour; 1 cup milk; pinch of salt.

Utensils—1 saucepan; wooden spoon.

Method—

1. Wash and peel onions.
2. Put them into a saucepan; cover with hot water; add salt.
3. Boil till tender.
4. Strain; put into a hot vegetable dish.
5. Cover with white sauce.

RICE PUDDING.

Materials—2 oz. rice; ½ teaspoonful salt; 2 eggs; 1 pint milk; 1 tablespoonful sugar; grated nutmeg.

Utensils—Saucepan; strainer; pie dish; whisk; basin; grater.

Method—

1. Wash rice; put it into a saucepan of boiling water; add salt.
2. Boil till soft; strain.
3. Place rice into a greased pie dish.
4. Beat eggs in a basin; add milk and sugar.
5. Pour over rice; mix; grate nutmeg over top.
6. Bake in a slow oven for half an hour.

MEAT CROQUETTES.

Materials—1 lb. steak or cold meat; 1 tablespoonful lard; 1 tablespoonful flour; ¼ cup milk or water; ½ teaspoonful salt; 2 pinches pepper; 1 cup white bread crumbs; 1 egg; 2 tablespoonfuls brown bread crumbs; dripping for frying.

Utensils—Mincing-machine; saucepan; wooden spoon; knife; frying-pan.

Method—

1. Pass meat through a mincing-machine.
2. Heat lard in a saucepan; when melted, add flour; blend well.
3. Add milk or water and meat; stir well.
4. Add salt, pepper, and bread crumbs; cook for 3 minutes; remove from fire.
5. Form into balls; dip in flour, beaten egg, and bread crumbs.
6. Shape into croquettes.
7. Fry in smoking fat; drain on brown paper; serve hot.

SULTANA SCONES.

Materials—½ lb. flour; ½ teaspoonful soda; 1 teaspoonful cream of tartar; ½ teaspoonful salt; 1 dessertspoonful lard; 2 tablespoonfuls sultanas; 1 tablespoonful sugar; ¾ cup milk.

Utensils—Bowl; sieve; cutter; brush; baking-tin.

Method—

1. Sift flour, soda, cream of tartar, and salt into a bowl.
2. Rub in lard; add sultanas and sugar.
3. Make into a soft dough with milk.
4. Cut into rounds; brush over with milk; put on a floured tin.
5. Bake in a hot oven for 15 minutes.

ONION SAUCE.

Materials—4 small onions; 1 teaspoonful salt; 1 tablespoonful flour; 1 tablespoonful butter; ½ pint milk.

Utensils—Knife; small saucepan; wooden spoon.

Method—

1. Peel onions; put them into a saucepan; add water and half the salt.
2. Boil for 30 minutes or until tender; strain; turn onions out on plate; cut them up into small pieces.
3. Melt butter or dripping in a saucepan; add flour; heat, stirring until the mixture is smooth.
4. Add milk gradually; boil for 3 minutes; add cut-up onions and remainder of salt; boil for 5 minutes.

PARSLEY SAUCE.

Materials—1 dessertspoonful butter; 1 dessertspoonful flour; ½ pint milk; 1 dessertspoonful chopped parsley.

Utensils—Saucepan; wooden spoon; knife.

Method—

1. Heat butter in a saucepan; add flour; stir till smooth; add milk gradually.
2. Cook for 3 minutes, stirring continually.
3. Remove from fire; add chopped parsley; stir well.

BOILED CHOKOES.

Materials—Chokoes; ¼ teaspoonful salt to each choko.

Utensils—Bowl; knife; saucepan.

Method—

1. Wash chokoes; peel them under water; cut them into even-sized pieces.
2. Heat water in a saucepan to boiling point; add salt.
3. Put chokoes into the saucepan; boil till tender; drain; serve with white sauce or melted butter.

Notes—

1. Chokoes are peeled under water to prevent staining the hands by the juice.
2. Vegetable marrow may be prepared, cooked, and served in the same way as chokoes.
3. Pumpkins may be prepared and cooked similarly; when tender the water should be drained off, the pumpkin well dried and mashed; butter, pepper, and salt should be added, and well stirred in before serving.
4. Carrots should not be peeled; the soft outside skin is easily removed by scraping; when prepared they are cooked in the same way as chokoes; it is necessary to allow 45 to 60 minutes for boiling carrots.
5. Turnips must be peeled; they must be boiled for 45 to 60 minutes; when tender they may be mashed, butter, salt, and pepper being added; or they may be served whole with white sauce.
6. Chokoes, pumpkin, and vegetable marrow may be baked in the oven with meat in the same way as potatoes.
7. Carrots and turnips may be boiled with corned meat; they are also sliced and added to haricot stews.

INVALID COOKERY.

LIQUIDS AND THEIR PREPARATION.

SECTION I.

ALBUMEN WATER.

Utensils—Basin; tablespoon; scissors; knife; cup and saucer.

Materials—1 white of egg, 2 tablespoonfuls boiled water; pinch of salt or sugar.

Method—

1. Put white of egg into a basin; cut it through and through with a pair of scissors or a knife.
2. Add cold boiled water, salt or sugar.
3. Strain into a cup; serve.

APPLE WATER.

Utensils—Jug; knife; squeezer; wooden spoon; tablespoon; teaspoon; strainer; tumbler.

Materials—1 cooking apple; 1 tablespoonful sugar; 1 pint water; 1 teaspoonful lemon juice; 1 oz. lemon peel.

Method—

1. Slice apple into jug.
2. Add sugar, lemon juice, and peel.
3. Add boiling water.
4. Stir with wooden spoon.
5. Cover; strain when cold.

BARLEY WATER (DECOCTION).

Utensils—Saucepan; strainer; squeezer; knife; tablespoon; teaspoon; cup and saucer.

Materials—3 tablespoonfuls barley; 1½ pint boiling water; 1 teaspoonful sugar; 1 teaspoonful lemon juice.

Method—

1. Wash barley; put it into a saucepan.
2. Add water; simmer for two hours.
3. Strain; add lemon juice and sugar.

BARLEY WATER (INFUSION).

Utensils—Jug; basin; squeezer; strainer; tumbler; knife; teaspoon; tablespoon.

Materials—1 lump sugar; tablespoonful barley; 3 gills water; 1 teaspoonful lemon juice; 1 oz. lemon rind.

Method—

1. Wash barley.
2. Put barley, sugar, lemon juice, and rind into a jug.
3. Add boiling water.
4. Cover; strain when cold.

BLACK CURRANT TEA.

Utensils—Jug; dessertspoon; teaspoon; squeezer; knife; tumbler.

Materials—1 dessertspoonful black currant jam; 1 teaspoonful lemon juice; 1 teaspoonful castor sugar; ½ pint boiling water.

Method—

1. Put jam, sugar, lemon juice into a jug.
2. Pour in boiling water.
3. Stir well; cover.
4. Stand near fire for twenty minutes.
5. Strain for use.

Note.—Any acid jam may be similarly used to make a refreshing drink.

CHOCOLATE.

Utensils—Saucepan; knife; whisk; jug; strainer; cup and saucer.

Materials—1 cup milk; 1 oz. chocolate; 1 egg.

Method—

1. Put milk into a saucepan; shred chocolate into it.
2. Stir over fire until the chocolate is dissolved.
3. Whisk an egg in a jug.
4. Strain chocolate over it.
5. Whisk till frothy.

LEMONADE.

Utensils—Jug; strainer; tumbler; knife.

Materials—1 lemon; 3 lumps sugar; 1 pint boiling water.

Method—

1. Put a small piece of rind into a jug.
2. Strain juice into the jug.
3. Add boiling water.

LEMON WHEY.

Utensils—Saucepan; knife; squeezer; strainer; tumbler.

Materials—1 gill milk; juice of ½ lemon; 1 lump sugar.

Method—

1. Put milk and sugar into a saucepan.
2. Bring to the boil.
3. Add lemon juice.
4. Strain; serve hot.

Note.—Wine or rennet may be used instead of lemon juice.

OATMEAL DRINK.

Utensils—Saucepan; strainer; cup and saucer; teaspoon.

Materials—1 tablespoonful oatmeal; ½ pint milk; ½ teaspoonful butter; pinch of salt and pepper.

Method—

1. Put oatmeal, butter, salt, and pepper into saucepan.
2. Add boiling milk.
3. Boil five minutes.
4. Strain; serve.

RICE WATER.

Utensils—Basin; saucepan; strainer; tumbler or cup and saucer; knife.

Materials—1 oz. rice; 1 quart water; 1 oz. cinnamon stick; pinch salt.

Method—

1. Wash rice.
2. Put rice, cinnamon, water, and salt into saucepan.
3. Simmer one hour.
4. Strain; serve hot or cold.

TOAST WATER.

Utensils—Jug; squeezer; teaspoon; muslin; tumbler; knife.

Materials—1 piece of toasted crust; 1 pint cold water; 3 drops lemon juice; 1 teaspoonful sugar.

Method—

1. Break up toast; put it into a jug; add sugar.
2. Add cold water; let stand till the water is straw coloured.
3. Add lemon juice.
4. Strain through muslin.

FRUIT PRESERVING.

APRICOT JAM.

Method—

1. Peel apricots; cut them into halves.
2. Remove stones; crack stones and remove kernels.
3. Put ¼ lb. kernels into cold water; bring to boil and peel.
4. Put apricots and part of sugar into a bowl in layers; allow fruit to stand twelve hours.
5. Put fruit and syrup into preserving pan with remainder of sugar, blanched kernels, and water.
6. Allow to cook slowly until apricots are soft and transparent.
7. When slightly cool pour into warm jars.
8. Cover down airtight.

Utensils—Knife, dish, preserving pan, saucepan, basin, jam jars, wooden spoon.

Materials—Apricots; 1 lb. crystallised sugar to each pound of fruit weighed without kernels.

Note.—Apricot jam may be made without peeling apricots.

APRICOT JAM MADE FROM DRIED APRICOTS.

Method—

1. Put apricots into a bowl; cover with cold water.
2. Wash fruit well; drain; cut fruit into halves; return apricots to bowl.
3. Cover with boiling water; allow to stand till the apricots are well soaked and plump.
4. Put fruit and water into a preserving pan.
5. Boil till the fruit is clear; add sugar, lemon juice, and almonds.
6. Boil till a small quantity jellies on a saucer.
7. Bottle, seal, cover securely.

Utensils—Bowl, cup, wooden spoon, squeezer.

Materials—1 lb. dried apricots; 8 cups boiling water, 8 cups sugar, 3 lemons, 6 blanched almonds.

Note.—Any dried fruit may be used in this way.

CRYSTALLISED APRICOTS.

Method—

1. Cut sound ripe apricots into halves.
2. Make a syrup of sugar and water.
3. Drop apricots into syrup; simmer ten minutes.
4. Lift out.
5. Drain overnight.
6. Return to syrup next day, and simmer three minutes.
7. Repeat process six times.
8. Spread out to dry thoroughly in a very cool oven.
9. Pack away in boxes between sheets of paper.

Utensils—Knife, saucepan, large dish.

Materials—Apricots; 1 lb. sugar to ½ pint water.

PRESERVED APRICOTS, NECTARINES, OR LARGE PLUMS.

Method—

1. Put firm apricots into hot water; wipe them till thoroughly dry; peel, stone, and halve if necessary.
2. Put fruit into a preserving pan; cover with rain-water.
3. Bring to boiling point; lift fruit out; drain.
4. Pack fruit into bottles, letting them settle down gradually.
5. Add 1 lb. sugar to each pint of liquor in which the fruit was boiled; boil for ten minutes; remove skum.
6. Strain syrup through flannel into a basin.
7. Ladle syrup into a jug; place a knitting needle in each bottle of fruit; add boiling syrup till the bottle overflows.
8. Seal down immediately; test by turning upside down.

Utensils—Bowl, jug, cup, preserving pan, cloth, strainer, flannel, knitting needle, lightning jars.

Materials—1 lb. sugar and 1 pint water to each 1-quart jar of fruit.

PRESERVED APRICOTS, NECTARINES, OR LARGE PLUMS (BY STEAM PRESSURE).

Method—

1. Put firm apricots into hot water; lift them out and dry them thoroughly.
2. Pack carefully into preserving jars; put a knitting needle into the jars.
3. Make a syrup of 1 cup of sugar to 1 cup of water.
4. Boil the syrup for three minutes; strain it into a jug.
5. Pour syrup over the fruit in the jars, taking care to fill each jar to the brim.
6. Put on covers.
7. Pack jars into the canner, taking care to prevent their knocking against one another.
8. Steam for time required to make fruit tender at 160 degrees.
9. Allow bottles to remain in canner till partially cooled down; fill up to overflowing with fruit, if necessary, and hot syrup.
10. Put on rings and covers immediately; turn upside down.

Utensils—Bowl, cloth, jars, preserving pan, cup, knitting needle, jug, canner.

Materials—Apricots, nectarines, or plums; 1 lb. of sugar to each pint of water.

DRIED APRICOTS OR OTHER STONE FRUIT.

Method—

1. Remove seed from fruit; press each apricot out flat.
2. Put them on flat tins in a warm oven for twelve hours.
3. Turn each apricot; return to oven.
4. Allow the fruit to remain in the oven till all moisture has evaporated.
5. Pack into boxes with sheets of white paper between the layers.

Utensils—Knife, flat tins, box, white paper.

Materials—Apricots or other stone fruit.

Notes.—

1. Fruit cannot be dried in a gas oven.
2. In dry, warm weather fruit may be dried out of doors; while drying the trays of fruit should be covered with muslin or net to keep off the insects.

PRESERVED PEACHES.

Method—

1. Peel the peaches carefully.
2. Place the peeled peaches in a single layer in a preserving pan.
3. Cover with tank water; simmer till the fruit is just tender.
4. Lift fruit out, pack carefully in jars.
5. Strain the liquor in which the fruit was cooked.
6. Return it to the preserving pan; add ½ lb. of sugar to each pint of liquor.
7. Bring to the boiling point; boil quickly for ten minutes, remove scum.
8. Cover fruit with boiling syrup till it overflows the lip of the bottle.
9. Place lid on immediately; seal; test for the presence of air or escape of syrup by turning the bottle upside down.
10. When cool, wash the bottles in blue water; wipe very carefully, store in a dark place.

Utensils—Bowl, silver knife, wooden spoon, spoon, preserving pan, cup, jug, flannel strainer, 1-quart preserving jars.

Materials—Peaches; 1 lb. sugar to 1 quart water for each jar.

PRESERVED PLUMS.

Method—

1. Wash and wipe plums carefully.
2. Put layer of sugar over bottom of jar.
3. Add layers of plums and sugar alternately until jar is filled to brim.
4. Fix rubber and cover securely.
5. Store until sugar is dissolved.

Utensils—Jars.

Materials—Large well-flavoured plums such as magnum bonum; 1½ lb. brewer's crystals to 1 lb. fruit.

PRESERVED PLUMS (SECOND METHOD, IN WATER).

Method—

1. Stem, wash, and wipe plums.
2. Pack carefully into bottles; put in a knitting needle.
3. Fill up bottles over the brim with boiling water.
4. Seal carefully, test by turning the bottle upside down.
5. Store in a dark place.

Utensils—Bowl, cloth, jug, cup, spoon, knitting needle, quart jars.

Materials—1 quart plums; 1 pint water to each jar.

PEACH JAM.

Method—

1. Rub, pare, and cut up peaches; remove stones.
2. Put fruit into preserving pan; add sufficient water to cover bottom of pan.
3. Bring to boiling point; boil for ten minutes.
4. Add sugar and lemon juice; boil for thirty minutes or till a small quantity jellies on a cool plate.
5. Bottle, seal, and cover.

Utensils—Bowl, knife, preserving pan, cup, plate, wooden spoon, jars.

Materials—Peaches; ¾ to 1 cup sugar to each cup of pulp; 1 lemon to 4 cups pulp.

PEACH CONSERVE.

Method—

1. Wash fruit, rub it well, peel if necessary.
2. Cut into halves and remove seeds.
3. Put sugar and water into a preserving pan, bring to boiling point.
4. Add fruit; boil until tender.
5. Lift out fruit carefully.
6. Boil syrup rapidly for fifteen minutes, pour it over fruit to overflowing; seal jars.

Utensils—Preserving pan, knife, wooden spoon, jars.

Materials—Peaches; 1 cup sugar to 1 cup water.

Note.—Quinces, cooking pears, apples, or plums may be used for this conserve.

LAUNDRY WORK.

SUMMARY.

Treatment of Clothes that may be Boiled.

Notes—

1. All stains and dirty marks must be removed.
2. The clothes must be kept a clear white colour.
3. The material must not be injured.

Processes.

1. Soak them for at least 12 hours in cold water to loosen dirt.
2. Move them about vigorously in steeping water; wring out; place in tubs of clean warm water.
3. Wash out dirty marks by rubbing one part of the garment against another part, using soap to loosen the dirt and taking the cleaner articles first; wring out and place in clean warm water.
4. Rinse through water till the soap and dirty water are removed; wring.
5. Put into boiler; boil for 20 minutes to improve the colour.
6. Lift out of boiler; strain off soapy water.
7. Rinse through clean cold water to remove soap; wring.
8. Pass articles that are to be starched through boiled starch.
9. Shake well; peg out to dry in the open air if possible.

Treatment of Clothes that may Not be Boiled.

Notes—

1. Flannels and woollen must be sorted into—
   (*a*) White flannels.
   (*b*) Jaeger and natural-colour woollens.
   (*c*) Coloured flannels and woollens.
2. Woollen garments shrink if allowed to lie about wet.
3. If soap is rubbed on flannels, the soda in it hardens them and turns white wool yellow.
4. Cold or hot water injures flannels and woollens; warm water is best.
5. Woollens should not be dried in the sun nor directly in front of a fire. They should not be allowed to steam.

Treatment of White Flannels.

1. Shake them to remove dust.
2. Prepare warm water by mixing it in the proportion of 2 quarts of boiling water to 3 quarts of cold water.
3. Add enough melted soap to make a lather; add a few drops of ammonia to make the water soft and to remove grease.
4. Squeeze the articles gently in the water between the hands, but do not rub them. Turn them inside out and repeat the process till they are clean.
5. Rinse them in water the same heat until all the soap is removed.
6. Fold the articles and pass them through a wringer two or three times.
7. Shake them well to raise the nap.
8. Dry them in the open air, if possible, hanging them up by the thickest part.
9. Iron when nearly dry. Cotton bands must be ironed till quite dry.

Note.—Jaeger and natural colour woollens may be washed in the same way, except that they may be steeped in the prepared water (warm water, melted soap, and ammonia) for 20 minutes, the vessel being covered to prevent the escape of the ammonia.

Treatment of Coloured Woollen Garments.

These may be washed in the same way as white woollens, with the omission of ammonia, because it affects certain colours. The articles must be washed and dried quickly to prevent the colours from running. Salt is added to the rinsing water to assist in fixing the colour. One tablespoonful of vinegar to 4 quarts of water may be used to brighten colours.

Orchard Notes for December.

THE COASTAL DISTRICTS.

THE planting of pineapples and bananas may be continued, taking care that the ground is properly prepared and suckers carefully selected, as advised previously in these Notes. Keep the plantations well worked and free from weeds of all kinds, especially if the season is dry. New plantations require constant attention, in order to give young plants every chance to get a good start; if checked when young they take a long time to pull up and the fruiting period is considerably retarded. Small areas well worked are more profitable than large areas indifferently looked after, as the fruit they produce is of very much better quality. This is a very important matter in the case of both of these fruits, as with the great increase in the area under crop there is not likely to be a profitable market for inferior fruit. Canners only want first-class pines of a size that will fill a can, and cannot utilise small or inferior fruit, except in very limited quantities, and even then at a very low price. Small, badly filled bananas are always hard to quit, and with a well-supplied market they become unsaleable. Pineapple growers, especially those who have a quantity of the Ripley Queen variety, are warned that the sending of very immature fruit to the Southern markets is most unwise, as there is no surer way of spoiling the market for the main crop. Immature pineapples are not fit for human consumption, and should be condemned by the health authorities of the States to which they are sent.

Citrus orchards require constant attention; the land must be kept well worked and all weed growth destroyed. Spraying or cyaniding for scale insects should be carried out where necessary. Spraying with fungicides should be done where the trees show the need of it. A close lookout must be kept for the first indications of "maori," and as soon as it is discovered the trees should either be dusted with dry sulphur or sprayed with the lime-sulphur, potassium, or sodium sulphide washes. Borer should be looked for and destroyed whenever seen.

Early grapes will be ready for cutting. Handle carefully, and get them on to the market in the best possible condition. A bunch with the bloom on and every berry perfect will always look and sell well, even on a full market, when crushed and ill-packed lines are hard to quit.

Peaches, plums, papaws, and melons will be in season during the month. See that they are properly handled. Look out for fruit fly in all early ripening stone fruit, and see that none is left to lie under the trees to rot and thus breed a big crop of flies to destroy the mango crop when it ripens.

Keep leaf-eating insects of all kinds in check by spraying the plants on which they feed with arsenate of lead.

Look out for Irish blight in potatoes and tomatoes, and mildew on melons and kindred plants. Use Bordeaux or Burgundy mixture for the former, and finely ground sulphur or a sulphide spray for the latter.

THE GRANITE BELT, SOUTHERN AND CENTRAL TABLELANDS.

EARLY ripening apples, plums, apricots, peaches, and nectarines will be ready for marketing during the month. They are unsatisfactory lines to handle, as the old saw, "Early ripe, early rotten," applies to all of them; in fact, the season of any particular variety is so short that it must be marketed and consumed as quickly as possible. All early ripening deciduous fruits are poor carriers and bad keepers, as their flesh is soft and watery, deficient in firmness and sugar, and cannot, therefore, be sent to any distant market. The available markets are quickly over-supplied with this class of fruit, and a glut takes place in consequence. Merchants frequently make the serious mistake of trying to hold such fruits, in the hope of the market improving, with the result that, instead of improving, the market frequently becomes more and more congested, and held-over lines have to be sent to the tip. There is only one way to deal with this class of fruit, and that is to clear the markets daily, no matter what the price, and get it distributed and into consumption as rapidly as possible by means of barrowmen and hawkers. Most early ripening fruits are useless for preserving in any way, their only value being what they will bring for consumption whilst fresh. This being so, it is only a waste of time and money to forward immature, undersized, and inferior fruit to market, as it is not wanted, and there is no sale for it. It should never have been grown, as it is frequently only an expense to the producer, besides which, unless the fallen or over-ripe fruit is regularly and systematically gathered and destroyed in the orchard, it becomes a breeding ground

for fruit fly and codlin moth, as well as of fungi, such as those producing the brown and ripe rots. Early ripening fruits should, therefore, be carefuly graded for size and quality, handled, and packed with great care, and nothing but choice fruit sent to market. If this is done, a good price will be secured, but if the whole crop—good, bad, and indifferent—is rushed on to the local markets, a serious congestion is bound to take place and large quantities will go to waste.

Orchards and vineyards must be kept in a state of perfect tilth, especially if the weather is dry, so as to retain the moisture necessary for the development of the later ripening fruits. Where citrus fruits are grown, an irrigation should be given during the month if water is available for this purpose, excepting, of course, there is a good fall of rain sufficient to provide an ample supply of moisture.

Codlin moth and fruit fly must receive constant attention and be kept under control, otherwise the later-ripening fruits are likely to suffer severely from the depredations of these serious pests.

Grape vines must be carefully attended to and sprayed where necessary for black spot or downy mildew, or sulphured for oidium. Where brown rot makes its appearance, spraying with the potassium or sodium sulphide washes should be carried out. Leaf-eating insects of all kinds can be kept in check by spraying with arsenate of lead.

Farm Notes for December.

ALTHOUGH November is regarded generally as the best period for planting the main maize crop, on account of the tasseling period harmonising later on with the summer rains, December planting may be carried out in districts where early frosts are not prevalent, provided a known quick maturing variety of maize is sown.

To ensure a supply of late autumn and winter feed, dairymen are advised to make successive sowings of maize and sorghums, to be ultimately used either as green feed or in the form of ensilage. The necessity for such provision cannot be too strongly urged. Farmers who have not had any experience in building an ensilage stack can rest assured that, if they produce a crop for this purpose, information and instruction on the matter will be given on application to the Under Secretary for Agriculture and Stock; also that, whenever possible, the services of an instructor will be made available for carrying out a demonstration in ensilage-making for the benefit of the farmer concerned and his immediate neighbours.

In districts and localities where supplies of lucerne are not available, sowings of cowpeas should be made, particularly by dairymen, as the lack of protein-yielding foods for milch cows is a common cause of diminished milk supplies and of unthriftiness of animals in dairy herds. Cowpeas and lucerne can be depended upon to supply the deficiency. The former crop is hardy and drought-resisting. When plants are to be used as fodder, it is customary to commence to feed them to stock when the pods have formed. Animals are not fond of cowpeas in a fresh, green state; consequently the plants should be cut a day or two before use. Economy is effected by chaffing beforehand, but the plants can also be fed whole. Chaffed in the manner indicated, and fed in conjunction with green maize, or sorghum, when in head, in the proportion of one-third of the former to two-thirds of the latter, a well-balanced ration is obtainable. Animals with access to grass land will consume from 40 to 50 lb. per head per day; a good increase in the milk flow is promoted by this succulent diet. The plant has other excellent attributes as a soil renovator. Pig-raisers will find it invaluable also.

A great variety of quick-growing catch crops, suitable for green fodder and ensilage purposes, may also be sown this month, notably Sudan grass, white panicum, giant panicum (liberty millet), Japanese millet, red and white French millet. Well prepared land, however, is required for crops of this description, which make their growth within a very limited period of time. French millet is particularly valuable as a birdseed crop, the white variety being more in favour for this purpose.

Successive sowings may be made of pumpkins, melons, and plants of this description.

In districts where onions are grown, these will now be ready for harvesting. If attention is given, in the case of garden plots, to bending over the tops of the onions, maturity of the crop is hastened. Evidence will be shown of the natural ripening-off process, and steps should be taken to lift the bulbs and to place them in windrows until the tops are dry enough to twist off. If a ready market is not

available, and it is decided to hold over the onions for a time, special care should be taken in handling. Storage in racks in a cool barn is necessary; otherwise considerable deterioration is to be expected. Improved prices are to be looked for in marketing by grading and classifying produce of this description.

Cotton areas which were subjected to a thorough initial preparation, thereby conserving a sufficiency of moisture for the young plants, should now be making good headway and sending their taproots well down. Keep down all weed growth by scarifying as long as the growth will admit of horse work.

THE BENEFIT OF GREEN MANURE.

"Green" Manuring—the turning under of a growing crop—benefits the soil in two ways. It enriches the soil, in the first place, by supplying it with a considerable amount of readily available plant-food, and, in the second place, by adding humus, and thus improving the soil's texture and its power of absorbing and retaining moisture. When a manure crop is buried, the surface soil becomes enriched by the nourishing materials which the crop during the period of its growth had drawn from the air and from the lower portions of the subsoil, and this material is now placed within the reach of the succeeding crop.

During the growth of the plant the soil has, in addition, been stirred up and disintegrated by the development of the roots. When ploughed under, provided sufficient moisture and warmth are present, the buried mass decomposes with more or less rapidity.

A further important result is the formation of carbonic acid by the decomposition of the buried crop. Carbonic acid is given off abundantly in the fermentation of the mass, and assists in the disintegration of the soil and in rendering available the plant-food contained in it.

Green manuring is effective both in sandy and on heavy clay soils, and indeed on all soils deficient in humus. On sandy soils the effect of green manuring is to consolidate the soil, the humus formed binding the particles together. On clay soils, the effect of the addition of humus and the production of carbonic acid is to loosen and aerate the particles. When conditions as to warmth and moisture are favourable, and the crop decomposes fairly rapidly, the production of soluble plant-food proceeds with considerable rapidity. This is especially the case in respect of nitrogen, which is the principal manurial ingredient obtained from green manure. Nitrification (that is, the conversion of the nitrogenuous material of the plant into soluble nitrates) takes place quite rapidly. In sandy soils, green manure nitrifies more rapidly than manures like dried blood, bonedust, &c., and only a little more slowly than ammonium sulphate; while in stiff clay soil the green crop nitrifies very much more rapidly than either sulphate of ammonia or animal manures.

With regard to the kind of crop to be used for the purpose of green manuring, a good deal of latitude is permissible. Any crop that is rapid and luxuriant in growth, and that can be readily turned under, is suitable for the purpose, and the selection will be guided by considerations such as the time of year at which it is to be grown, its suitability to soil and district, &c. Among the most effective crops for the purpose are leguminous plants, such as clover, velvet beans, peas, &c., since these are specially valuable on account of their power of obtaining their nitrogen from the air. They are, therefore, specially suitable for soils poor in nitrogen, and are of high value in enriching the soil with this ingredient.

It must be borne in mind in all cases that green manure depends for its success upon the existence of conditions favourable to the decomposition of the buried green crop—namely, sufficient warmth and moisture. If the land is quite dry, the crop will remain buried without decomposing for a considerable period, and its beneficial effect will be deferred.

THE JOURNAL IN AMERICA.

Writing from Yakima, Washington, U.S.A., an American farmer says, inter alia, "The 'Queensland Agricultural Journal' is an interesting publication, and I would like to know the subscription price to farmers in America."

ASTRONOMICAL DATA FOR QUEENSLAND.

TIMES COMPUTED BY D. EGLINTON, F.R.A.S., AND A. C. EGLINTON.

TIMES OF SUNRISE, SUNSET, AND MOONRISE.

AT WARWICK.

	November, 1931.		December, 1931.		MOONRISE. Nov., 1931.	Dec., 1931.
Date	Rises.	Sets.	Rises.	Sets.	Rises.	Rises.
					p.m.	p.m.
1	5.5	6.7	4.52	6.30	11.28	11.41
2	5.4	6.7	4.52	6.30	11.28	...
					a.m.	a.m.
3	5.4	6.8	4.52	6.31	12.19	12.16
4	5.3	6.8	4.53	6.32	1.3	12.48
5	5.2	6.9	4.53	6.33	1.41	1.21
6	5.2	6.10	4.53	6.34	2.15	1.54
7	5.1	6.10	4.53	6.34	2.47	2.31
8	5.1	6.11	4.53	6.35	3.23	3.13
9	5.0	6.12	4.53	6.35	3.58	4.4
10	4.59	6.13	4.54	6.36	4.40	5.2
11	4.59	6.14	4.54	6.37	5.23	6.4
12	4.58	6.15	4.54	6.38	6.21	7.7
13	4.58	6.16	4.54	6.38	7.20	8.8
14	4.57	6.16	4.54	6.39	8.21	9.9
15	4.57	6.17	4.54	6.39	9.24	10.8
16	4.56	6.18	4.55	6.40	10.23	11.1
17	4.56	6.19	4.55	6.40	11.21	11.54
					p.m.	p.m.
18	4.56	6.20	4.56	6.41	12.15	12.42
19	4.55	6.21	4.56	6.41	1.9	1.34
20	4.55	6.22	4.57	6.42	2.1	2.30
21	4.55	6.23	4.57	6.43	2.53	3.25
22	4.54	6.23	4.58	6.43	3.43	4.24
23	4.54	6.24	4.58	6.44	4.39	5.21
24	4.53	6.25	4.59	6.44	5.36	6.19
25	4.53	6.25	4.59	6.45	6.34	7.17
26	4.53	6.26	5.0	6.45	7.27	8.11
27	4.53	6.27	5.0	6.46	8.29	9.0
28	4.52	6.27	5.1	6.46	9.25	9.41
29	4.52	6.28	5.1	6.46	10.16	10.16
30	4.52	6.29	5.2	6.47	11.2	10.50
31			5.3	6.47		11.23

Phases of the Moon, Occultations, &c.

3 Nov.	☽	Last Quarter	5	17 p.m.
10 „	●	New Moon	8	55 a.m.
17 „	☾	First Quarter	12	13 p.m.
25 „	○	Full Moon	5	10 p.m.

Perigee, 9th November, 1.0 a.m.
Apogee, 21st November, 2.48 a.m.

The Moon in its monthly round will pass through the following constellations: It will be in Gemini on the 1st and 2nd November; in Cancer to 3rd; in Leo to the 6th; in Virgo to the 9th; in Libra to the 10th; in Scorpio to the 11th; in Ophiuchus to the 12th; in Sagittarius to the 15th; in Capricornus to the 17th; in Aquarius to the 19th; in Pisces to the 22nd; in Aries to the 24th; in Taurus to the 27th; in Gemini to the 29th; in Cancer to the 30th.

Mercury will be in Libra on 1st November, and pass through Scorpio into Sagittarius to 30th November; Venus will be passing through Libra into Sagittarius; Mars from Libra, through Scorpio into Ophiuchus; Jupiter will be in Leo and Saturn in Sagittarius.

Those on the look-out for the November meteors, shortly after the middle of the month, may be well rewarded by the appearance of precursors of the Leonid-swarm, which is due more particularly in two years time.

The so-called conjunctions of Moon with a planet will occur this month either in daylight and too near the Sun to be observable, or as in the case of Saturn, when below the horizon in Queensland; but with binoculars Jupiter may be seen 3 degrees south of the Moon in the north-west about 10 a.m. on the 4th.

Mercury will rise about 26 minutes after the Sun on the 1st November, and set 38 minutes after it; on the 15th it will rise 53 minutes after the Sun and set one hour fifteen minutes after it.

Venus will rise 47 minutes after the Sun on the 1st and set one hour five minutes after it; on the 15th it will rise one hour four minutes after the Sun and set one hour twenty-two minutes after it.

Mars will rise at 6.24 a.m. and set at 7.56 p.m. on the 1st; on the 15th it will rise at 6.9 a.m. and set at 7.49 p.m.

Jupiter will rise at 1.20 a.m. and set at 12.15 p.m. on the 1st; on the 15th it will rise at 12.31 a.m. and set at 11.25 a.m.

Saturn will rise at 9.45 a.m. and set at 11.21 p.m. on the 1st; on the 15th it will rise at 8.54 a.m. and set at 10.32 p.m.

The Southern Cross will be so low down at sunset as to be practically invisible in Queensland until the early morning, when it may be seen lying on one side, 30 degrees east of the south pole; at 4 a.m. on the 1st and 1 a.m. on the 30th.

3 Dec.	☽	Last Quarter	2	51 a.m.
9 „	●	New Moon	8	16 p.m.
17 „	☾	First Quarter	8	43 a.m.
25 „	○	Full Moon	9	24 a.m.

Perigee, 7th December, 4.6 a.m.
Apogee, 18th December, 9.42 p.m.

Early in December, the three planets, Mars, Mercury and Venus will be above the western horizon very near to one another, affording a remarkably interesting spectacle after sunset. At first Mercury and Venus will be apparently nearest together, Mars being lower down and less prominent.

For places west of Warwick and nearly in the same latitude, 28 degrees 12 minutes S., add 4 minutes for each degree of longitude. For example, at Inglewood, add 4 minutes to the times given above for Warwick; at Goondiwindi, add 8 minutes; at St. George, 14 minutes; at Cunnamulla, 25 minutes; at Thargomindah, 33 minutes; and at Oontoo, 43 minutes.

The moonlight nights for each month can best be ascertained by noticing the dates when the moon will be in the first quarter and when full. In the latter case the moon will rise somewhat about the time the sun sets, and the moonlight then extends all through the night; when at the first quarter the moon rises somewhat about six hours before the sun sets, and it is moonlight only till about midnight. After full moon it will be later each evening before it rises, and when in the last quarter it will not generally rise till after midnight.

It must be remembered that the times referred to are only roughly approximate, as the relative positions of the sun and moon vary considerably.

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